AMERICAN MACHINIST

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American and Other Machinery Abroad.

[EDITORIAL CORRESPONDENCE.]

As our readers know, the foreign trade of American machinery builders has grown to very important proportions, and especially in the line of machine tools is increasing so rapidly as to be something in the nature of a phenomenon.

My object in coming over here at this time is to give to readers of the "American Machinist" as much as possible of that particular and specific knowledge of the situation, commercial and technical, which is gained by those American manufacturers who for two years past or more have been spending a portion of their time over here and who seem likely to come during the present season in even greater numbers than ever before. Aside from this the relation of the "American Machinist" itself to affairs over here and to this growing export of American machinery seemed to require that a wider personal acquaintance should be formed and a more intimate knowledge gained of how things are done over here and how they may seem likely to be done in the future.

LONDON AS A MACHINERY CENTER.

My time so far has been spent in London, where comparatively little is done in the way of machinery building, but which bears to the machinery interests of Great Britain much the same relation borne by New York to those of the United States. Queen Victoria street here, indeed, reminds one very much of Liberty street in New York. It is the headquarters of the machinery trade and, at least in the ground floor show rooms, American firms seem to predominate, and very many Americans who call themselves "exiled" are to be found in charge of them. It is not a particularly sad banishment, however, for most of them find London a very pleasant place in which to live and do business, and indeed I myself fail to see how anyone accustomed to New York can feel very much out of place here, or how anyone at all interested in the history and the destiny of the Anglo-Saxon race can fail to find here much of deep interest to him.

I find the "American Machinist" very well known here, and am already deeply indebted to very many English and American friends for kindnesses shown and for most valuable assistance in the prosecution of the work which forms the main object of my visit.

London is cosmopolitan in machinery circles as well as in others. Nearly every man you meet is as familiar with continental matters as with British, and usually has intimate and important trade relations on the continent. This gives him a certain broadness of view, which will certainly become more general also among our own machinery men as a result of their growing habit of foreign travel and increasing trade relations with the countries once contemptuously referred to by one of our public men when he inquired, "What have we to do with abroad?"

VARIOUS OPINIONS AS TO THE FUTURE.

I believe I can say that I am at least fairly free of that form of prejudice which condemns a thing simply because it is not American, and of course it is important for such an investigation as I am making here that prejudice should, so far as possible, be thrown aside and the real facts given as they appear, and in doing this I shall attempt also to give the views of others, and in some cases of men much better able to judge intelligently by reason of long residence here, aside from other advantages not necessary to mention.

Opinion here in London as to the future of trade in American machine tools is by no means unanimous. I find men engaged in the trade, and presumably well acquainted with it, who do not think it will be permanently large; but, on the other hand, I find many more who think it will be, and who seem able to give much the better reasons for their faith. Moreover, these last are in some cases backing up their opinions by cash and by expenditure of time and labor, which will be largely, if not entirely, lost to them if it turn out that they have not judged correctly.

A NEW COMPANY TO SELL TOOLS—PRACTICAL REPRESENTATIVES.

For instance, I have talked with an American who spent some time as a mechanic in American machine shops; has been a "works manager" here, and latterly engaged in the business of selling American machine tools, having altogether about six years' experience here, and who, as a result of his study of the situation, his experience and his knowledge of how our tools are regarded here, is now engaged in forming a company which will handle American tools exclusively—small and belted, up to the largest sizes. This company will start out with a large capital, and will make a point of having, not only men who can make sales of machine tools, but also men who thoroughly understand them, and can go into a shop, if need be, and show just how the tools can be operated to make them give the best results. This company expects to have a large show-room on Queen Victoria street, and will carry a large stock. A significant thing in this connection, perhaps, is that the experience of this gentleman has not been confined to the smaller sizes of machine-tools, but has extended to the heavier ones as well, and he informs me that he has every reason to believe that at least some success will be attained here with fairly large American lathes, planers, boring mills and other tools, but does not think much can be done in competition with the English slotter; which, by the way, seems to be a more popular and more widely used tool here than with us. He thinks the matter of having men thoroughly well acquainted with tools and their uses by practical experience with them is an important feature in introducing tools to men who have been accustomed to entirely different tools and entirely different methods of handling them; and the frequent need of such experts at home, either in the person of the builder himself or otherwise, would seem to indicate that he is certainly right with regard to the importance of their employment here, where in his opinion there has been a serious deficiency in that respect.

AN INSTANCE.

I had an illustration of this in a shop I visited where there are quite a number of American lathes of excellent reputation. The builder of these lathes and myself were being shown about the shop by the chief draftsman—a very pleasant, courteous and agreeable gentleman, wearing,

in accordance with universal London custom, a tall silk hat. I stopped a moment to talk with a man who was running one of these American lathes, and asked him how he liked it. He said it was a good lathe, and he liked it very well, but thought it would be better if it had a compound rest. The lathe had a taper attachment, and so the compound rest was not much needed for turning or boring tapers, but he explained that in facing it was difficult to move the carriage so as to get a fine cut of precisely the right depth, and he thought that if there was a screw by which the tool could be moved up to the cut it would be much better, and this a compound rest would give him. Any American machinist would, of course, be able to tell him how to overcome this difficulty, not necessarily because the American is smarter or the better mechanic, but because he is used to the American lathe, and when I told this man that we usually clamped the friction or closed the nut in such cases and then moved the carriage by turning the feed-rod or the lead-screw by hand to get the fine movement required, he at once saw the point, and I hope will not hereafter so much feel the need of a compound rest for a purpose for which it is seldom used in America, except on very large lathes; the lathe in this case being only about 16-inch swing—possibly 20-inch.

USE OF COMPOUND REST.

This insistence upon the necessity for a compound rest is constantly encountered here, and they usually think it necessary even in the smaller lathes down to 8-inch and 10-inch swing ("4-inch and 5-inch centers"). A taper attachment does not render it needless to them, for the reason indicated by the above incident, and because it somehow seems to them much better to feed a tool along on a small rest than to move the carriage on the bed. They will use the compound rest in this way for turning and boring where cuts are 2 inches to 4 inches long and seem to prefer it; so much so that one American in charge of a shop here who had taken pains to see whether this was really the better method or not, and had concluded not, had to positively prohibit such use of the compound slide on his American lathes and insist on the use of the carriage feed.

I noticed a curious working out of this idea on an English lathe of about 60-inch swing. An automatic feed was given to the slide of the compound rest by means of a cam secured to the spindle just in front of the main gear. Every time this cam came around it struck a lever which, by suitable connections, rotated a square shaft which ran along in front of the lathe bed, and from this shaft the screw of the slide was operated by other levers and connections and a ratchet and pawl. The movement of the slide was thus, of course, intermittent, and to say nothing of the ugliness of the arrangement and the fact that it seemed well calculated to be always in the way, I must confess I do not see where the advantage of such good work as had been done in constructing this lathe comes in if you are to turn an important journal, as was being done in this case, with a tool moved forward by jerks instead of by a constant and steady motion. I am unable to believe that a journal can be turned as near true in such a way as by a continuous feed motion, other things equal.

RATE OF WORKING.

The job of turning mild steel was being done at a cutting speed not a whit more than half what would be used in one of our own shops, and I saw drilling, gear cutting and boring of brass boxes at similarly slow rates. The gears were being cut on Whitworth machines arranged to cut two wheels simultaneously, using two cutters on separate spindles, saddles, etc., but the cutters were made in the manner long since discarded by us (fine teeth, not cut through), and the speed and feed were at such rates as would make the cost of the gears prohibitive with us. I think it perfectly safe to say that with our automatic gear-cutting machines the cost of cutting would not be one-fourth as much, and I really think it would be much less, though it should be remembered that cast iron here is harder and more difficult to work than with us. I have heard of one case in which identically the same Mushet tools carried across for the purpose of a test would do only half as much at one grinding in English as in American iron, all the conditions being as nearly as possible the same.

I have no doubt, however, that I shall see work done at least as expeditiously as we are in the habit of doing it, and in fact I am told by a very able engineer, born in Ohio, but here for about twenty years now, that all the standard machine-shop operations, such as planing, drilling, boring, etc., are done as fast here as in American and that turning is done faster; and this opinion is based upon definite records of what is done in both countries, his acquaintance with our shops being an extended one. He is especially interested in machine tools and gave me some figures of cost of production of essentially the same tool in San Francisco, in Philadelphia and here in England. He said the hours of labor per machine produced were in each case practically the same and that the machines were produced here at a lower cost on account of the lower wages and in just about the same proportion.

SOME CONSERVATISM.

Surely this could not have been done, however, in some of the shops he told me about in the course of the same conversation, and which he gave as characteristic English establishments. One of these had ordered some new lathes to be exact duplicates of others purchased of the same maker about 35 years before, and when my friend asked them why they had thus set aside all the progress that had been made in the intervening time and had bought lathes far less efficient than those to be had now, they replied that they had started in business with such lathes and they had always been satisfactory, their foremen and workmen were accustomed to them and understood them, and it was therefore thought best to have the same lathes. American readers should consider, however, that this is not quite so ridiculous here as it would be to do the same thing in America, because there is not nearly so much difference between English lathes made 35 years ago and those made and commonly sold to-day, as there is between American lathes of the corresponding periods.

A name here is worth far more than with us. A man does not expect to spend a week or two over the drawing board, bring out a new machine, and at once commence to do a good business. He expects to spend lots of time—five, even ten years—in building up his business; but when once established and with his "connections" formed, he is correspondingly secure, and it is difficult for a newer competitor to supplant him. Establishments are not unknown in America wherein the wish is occasionally expressed that we might have a little more of this sort of conservatism which causes men to stick to those who have served them well. But they are, of course, the older and better known establishments in whose favor such a feeling works.

One man of wide experience with whom I talked said there was none of that bargaining or comparing of one machine with another as to prices, dimensions, etc., that is so common with us, but that the usual custom here among the best classes of manufacturers is to recognize that tool-building is a separate and distinct art or branch of engineering, not ordinarily understood except by those engaged in it; that such tool buyers usually become the "clients" of some certain tool builder, and when they require tools simply tell him so and let him supply such tools as his judgment dictates. This relation is continued much the same as would be the case with a lawyer or other professional man so long as it is mutually satisfactory, the customer or "client" never thinking of dictating or even suggesting points about tools. This is reducing the matter to a profession, and throwing entirely into the background the commercial side which is so prominent with us. I am sure I don't know which plan is, upon the whole, the best; each has its obvious advantages.

The experience of the man I have referred to is evidently by no means universal here, however, for I find others who say that British tool buyers are very free to suggest changes in tools they may be considering the purchase of, and that, in fact, they sometimes insist upon such

changes being made before they will order them. It often happens, however, that after the American tools have been once used, those ordered subsequently are accepted as regularly built, and there is undeniably something about the better tools of our make that causes them to win their way, usually, though the process is sometimes a slow one. F. J. M.

London, April 17th.

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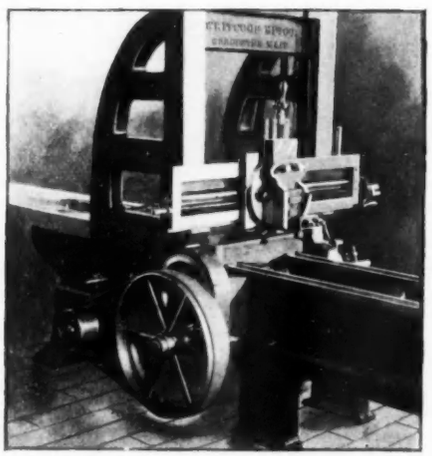
A New Planer Drive.

BY JOHN RANDOL.

Certain features of planer-driving mechanism are repeated in every spur-geared metal planing machine now offered for sale. The power is taken into the machine by a high-speed belt, and the belt-driven shaft carries a pinion which forms the first member of a train of speed-reduction gearing which terminates, in American practice, in a large spur wheel meshing into the table-rack. In some, and I think the general, English practice the bull-wheel is not used; the final pinion of the speed-reducing train is meshed directly with the table-rack. We have repudiated this practice, and generally use the "bull-wheel," which is simply a large-diameter intermediate gear driven by the final pinion of the reducing train, and driving the table-rack. Our argument has always been that the "bull-wheel" gave more teeth in contact with the rack, and hence was favorable to long life, and also we have argued that the large-diameter intermediate drove the rack in a more nearly direct line, and with less table-lifting influence than could be had by the pinion. There is, in fact, no difficulty experienced from the lifting action of the small pinion on the rack in the English planers, and it would seem from the present experiment at the Whitcomb Planer Shops, Worcester, Mass., that the "bull-wheel" is a wholly unwarranted construction expense, which serves no useful purpose. There can be no doubt that the bull-wheel creates considerable friction, because it introduces one extra contact of gear teeth and two heavy journals which have no place in a planer if the pinion is made to gear directly with the table rack. The Whitcomb "second-belted" planer drive, as first built some three or four years ago, and constantly running ever since in the Whitcomb shops, uses a very small final pinion, which drives the table rack direct, and this planer table has never shown any tendency to lift, nor has it in any way behaved in such a manner as to indicate that the addition of the time-honored "bull-wheel" would be a betterment.

Yet, in spite of years of perfectly successful use of this direct gear in connection with the "second-belted" planer drive, Mr. Whitcomb was, and is, sufficiently the slave of tradition and "established practice" to have placed a bull-wheel in the only one of his "second-belted" planers which has ever left his shop. A customer who had long been familiar with the performance of the planer in the Whitcomb shops, insisted on being supplied with a similar machine for his own use, but Mr. Whitcomb built this planer with a bull-wheel, just exactly why does not appear; Mr. Whitcomb says he thought "maybe it was just as well to put the bull-wheel in."



NEW PLANER DRIVE.

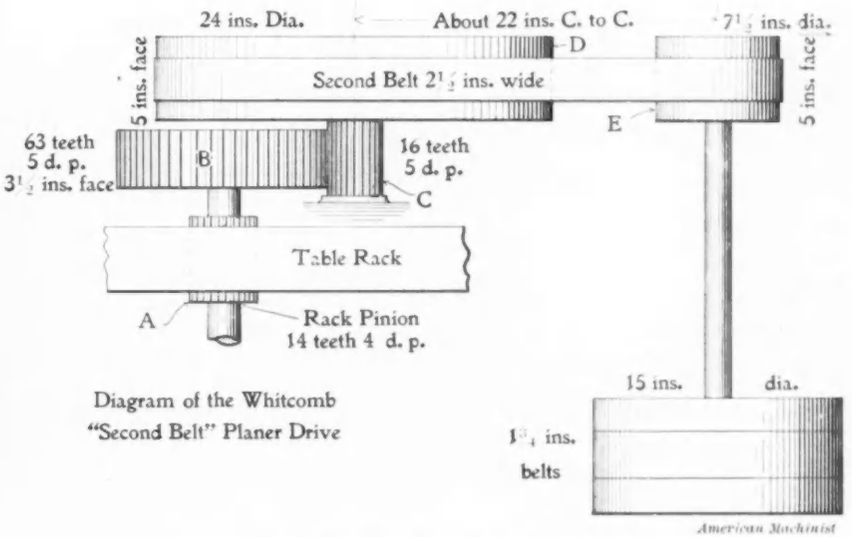


Diagram of the Whitcomb "Second Belt" Planer Drive

DIAGRAM OF PLANER DRIVE.

The arrangement of the drive, as used by Mr. Whitcomb, is shown in Fig. 1, which is a diagram of the action. As will be noted, the usual vertical driving belts are employed, but the first shaft, instead of carrying a pinion, carries the pulley *E*, which drives the pulley *D*, mounted on a sleeve extension of the pinion *C*, which drives the spur-gear *B* fast on the shaft of the pinion *A*, meshing directly into the table-rack.

At first sight this seems no very great modification of the ordinary spur-geared planer drive, as it simply introduces a belt as the first speed-reducing member; but no one familiar with metal planers could see this drive at work without being immediately aware of its novelty and superiority of action. The speed of the pinion *C* is so greatly reduced as to make the action of *C* and *B* perfectly noiseless, while the table reverses with a smooth, soft action so very easy on the dogs, belt shipper and feed-action parts as to be very noticeable.

On the occasion of a recent visit to the Whitcomb shops, I had a piece of cast iron put on the table, and took a cut over it myself, to know precisely what the drive could do. The feed was 0.053 inch, the vertical depth of cut 15-32 inch, and the width of the chip measured on the incline was 17-32 inch. It will be seen that this is a sufficiently heavy cut for a planer of this small size shown. Mr. Whitcomb says that the same number of driving elements are suitable for planers of any size.

The tool enters the cut more softly than with an all-gearing drive, and perhaps the movements of this machine could not be better described than in Mr. Whitcomb's own remark: "It is the most 'comfortable' running planer I ever saw."

The vertical belts on this planer were old and slack when I took the cut referred to, and the second belt was only 2½ inches wide, instead of 5 inches, the belt width which the pullies are intended to carry. An old piece of 2½-inch belting was at hand when this planer was first set up, and was laced on for a trial, and performed so well that it has stayed there for something like three years of constant use, which is good proof that the original design included ample belt width.

The speed reduction, as per Fig. 1, gives a first driving-belt speed of 1,080 feet per minute for 20 feet of table travel, or about 27 feet of second-belt travel to 1 foot of table travel.

An experiment like this, where a machine tool is driven by devices which defy established practice, and yet gives very superior results when placed side by side with the best tools designed on accepted lines during a three years' trial, is calculated to disturb orthodox ideas.

This drive is relatively cheap to construct, runs quietly and bids fair to be more durable than the common planer gearing.

The rack-driving pinion engages the rack about 12½ inches to the rear of the cutting tool, but this is rather an advantage than otherwise to the user, as it calls for a bed longer than the shortest bed possible where the rack engagement is made in a vertical line below the tool-point. Some of the English planers which drive the table-rack directly from the final pinion have the extremely objectionable feature of a spur gear in front of the housings placed so high that the top of this spur gear stands an inch or two above the top of the planer table, so that a flat piece which hangs over the width of the table must be blocked up to have its under side clear the top of the large gear. The Whitcomb drive avoids this fault by carrying the gear to the rear, in which position it is covered by the housing or upright, and is, of course, entirely out of the way.

Something New in Planers.

As we publish from week to week the various developments in machine tools and shop practice, it seems to us that there never was a time when progress in those fields was as rapid as now. Many years ago, in the early days of this paper, "Chordal," in one of his inimitable letters, deplored the lack of originality among machine tool designers, as shown by the then lack of machines designed for special purposes, and he advised machine tool designers to take lessons from the builders of woodworking machinery and learn something about the building of machines intended for special purposes. We do not think the same criticism could be justly made to-day, and we know of no better illustration of the striking progress in machine shop methods during the past twenty years than this fact.

We illustrate herewith a new departure in planers, which may not be considered pertinent as regards special machines, but it certainly is pertinent as regards the general spirit of progress in machine tool design. Our readers will remember the facts brought out last year in the electrical tests of the old and new style Sellers' planers at the Baldwin Locomotive Works. These tests showed conclusively that, quite contrary to the general impression, the power required to reverse a planer of the ordinary type was brought about by the necessity for reversing the pulleys, and not by the reversal of the table—the high speed of the pulleys, compared with the low speed of the table, much more than making up for the difference in weight. The present planer takes advantage of this fact, and, like the new Sellers planer, is arranged to permit the belt pulleys to run continuously without reversing; the reversal is accomplished by friction clutches which are operated in a novel manner by compressed air.

Fig. 1 shows an elevation of the planer from the operator's side, and Fig. 2 shows a plan, partly in section. The compressed air operating cylinder will be seen at *a*, and it receives its supply of air from the general compressed-air supply now so

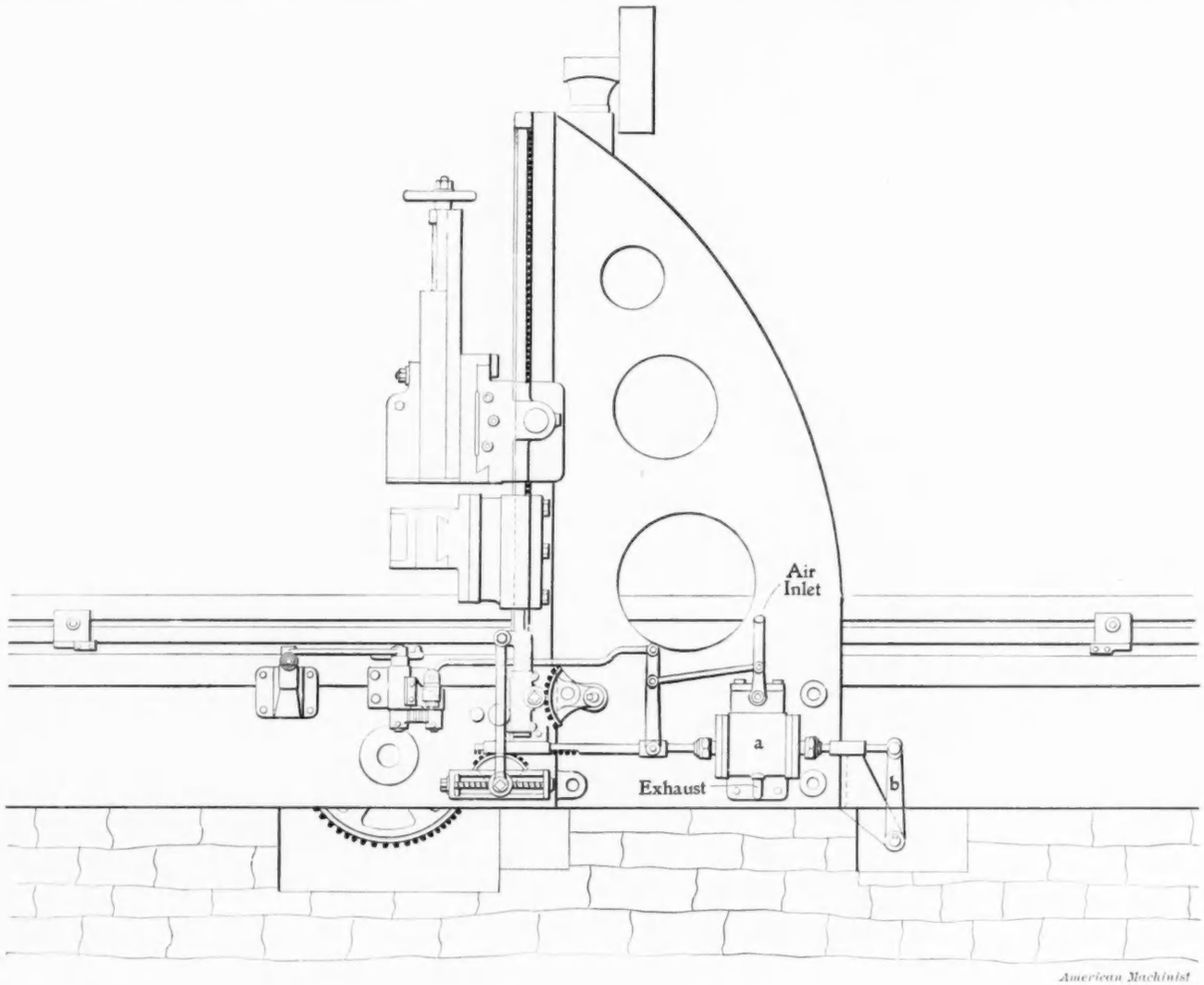


Fig. 1

SIDE ELEVATION OF PNEUMATIC REVERSE PLANER.

common in machine shops, or, where there is no such supply, a small pump is attached to the machine. The valve which controls the admission and exhaust of the air will be seen on the top of the cylinder, where it is operated by the usual levers and dogs. The throwing of the valve operates the piston, which in turn operates the feed motion through the piston rod extending from the left-hand end of the cylinder, and likewise operates the reversing clutch by means of the piston rod extending from the right-hand end, which connects with the clutch upon the opposite side of the machine through the lever arm *b* and rock shaft *c*. A moment's consideration will show that the continuous running of the belt accomplishes other objects besides saving the reversal of the pulleys. As the belts are not shifted, they are not limited in width by any of the conditions prevailing in the usual construction, and a planer made on this plan may be varied in its speed of cutting stroke for different materials, and in its speed of return for different weights of work being handled, by suitable cone pulleys—the speed of the two strokes being independent of one another. The usual speed of return, as compared with the ordinary cutting speed, is from 6-8 to 1.

This machine is the invention of Alexander Gordon, and has been brought out by the Niles Tool Works, of Hamilton, O., who have several machines, ranging in size from 30 x 30 inches to 10 feet x 10 feet, in operation at their own works. A 54-inch planer for (locomotive) frames with 35-foot travel of table, is now under construction. The quick return is obviously highly desirable on this class of work, because of the length of the machine and the comparatively slow speed of the cutting stroke.

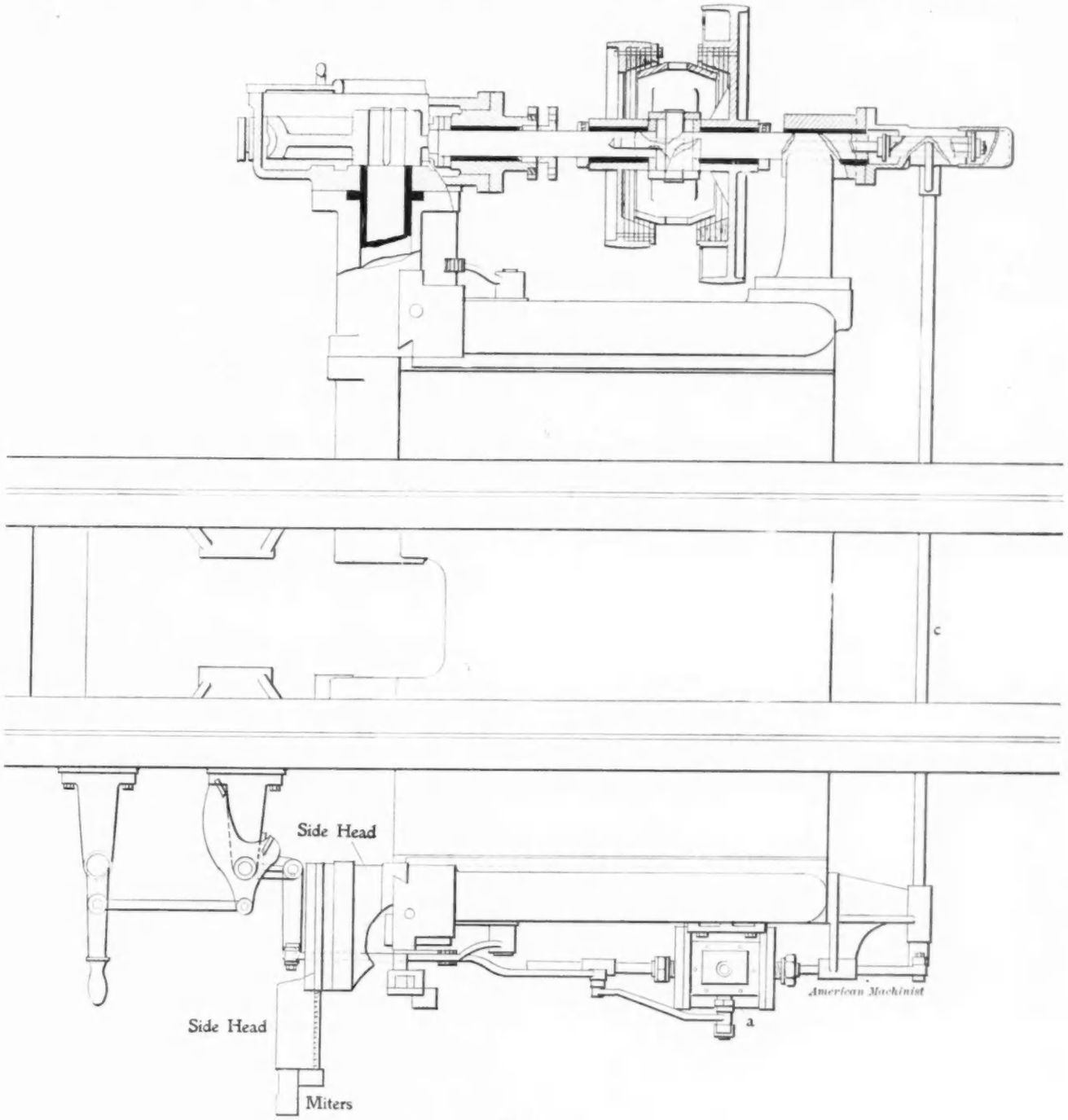
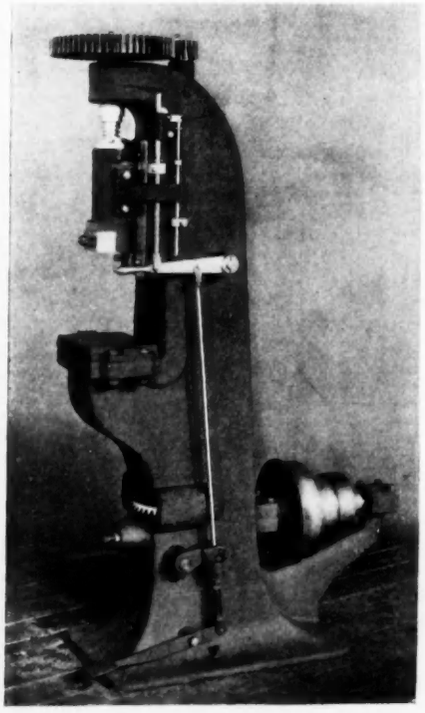


Fig. 2

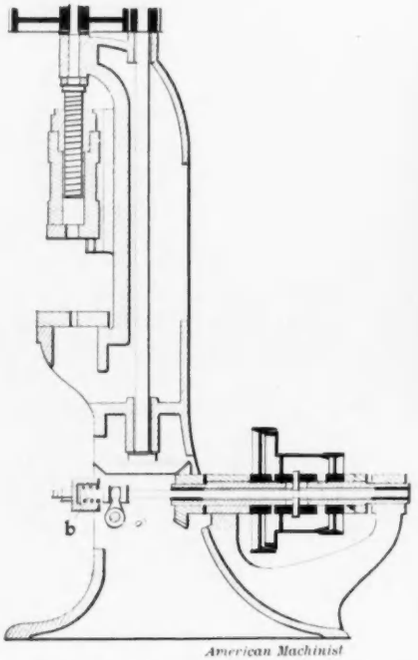
PLAN OF PNEUMATIC REVERSE PLANER.

Broaching Machines.

We present herewith engravings of two forms of broaching presses which, though they have been designed with special reference to the requirements of bicycle



VERTICAL BROACHING MACHINE.



SECTION OF BROACHING MACHINE.

work, are of course equally adapted to any work of similar character.

Considering first the upright machine, its driving and reversing mechanism is shown in the sectional view, by which it is seen that friction clutches are made use of, and quick return provided for by suitably proportioned pulleys; and, since the motion of the slide is imparted by a screw, the speed can of course be uniform from end to end of the stroke, and at the maximum rate.

When the work is in position, the operator presses the treadle and this, by means of the hooked lever arm just above the treadle, engages the larger of the friction clutches. In doing so the helical spring is compressed and at the same time the larger of the two parallel vertical rods at the right of the machine is engaged by a latch near the top, which latch is operated by the smaller vertical rod and held in engagement by the helical spring which surrounds a portion of that rod. This rod passes freely through an arm which is attached to the slide, and when, by the descent of the latter, the latch is disengaged, the spring *b* instantly throws the clutch and reverses the motion, the slide then rising rapidly until the arm comes into contact with the clamp collar on the larger vertical rod which disengages the return motion clutch and stops the machine. Thus the machine makes a complete cycle in a working and return stroke automatically.

The number of strokes per minute varies in proportion to the length of the stroke or the speed of the machine, being, on a six-inch stroke, four per minute for tool steel and about five to six for mild steel.

The horizontal machine is operated by mechanism which is substantially equivalent to that of the vertical machine, but the broach is pulled through. The horizontal machine can exert a pressure of 18 to 20 tons and weighs 1,400 pounds. The machines are made by Rudolphi & Krummel, Chicago, Ill.

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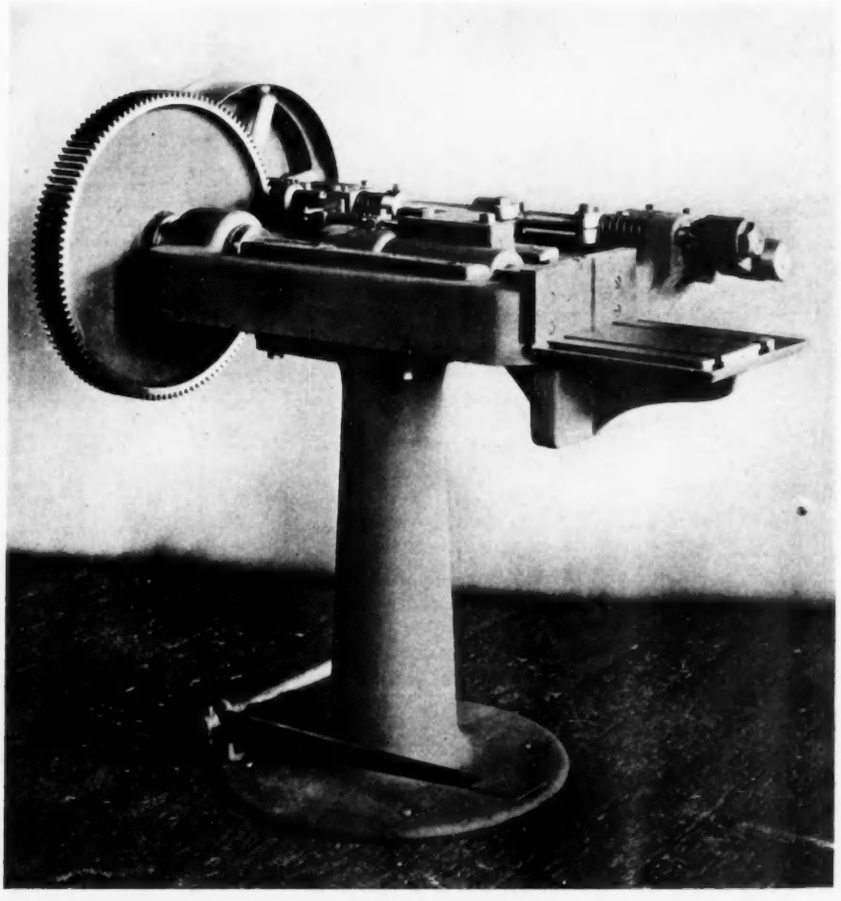
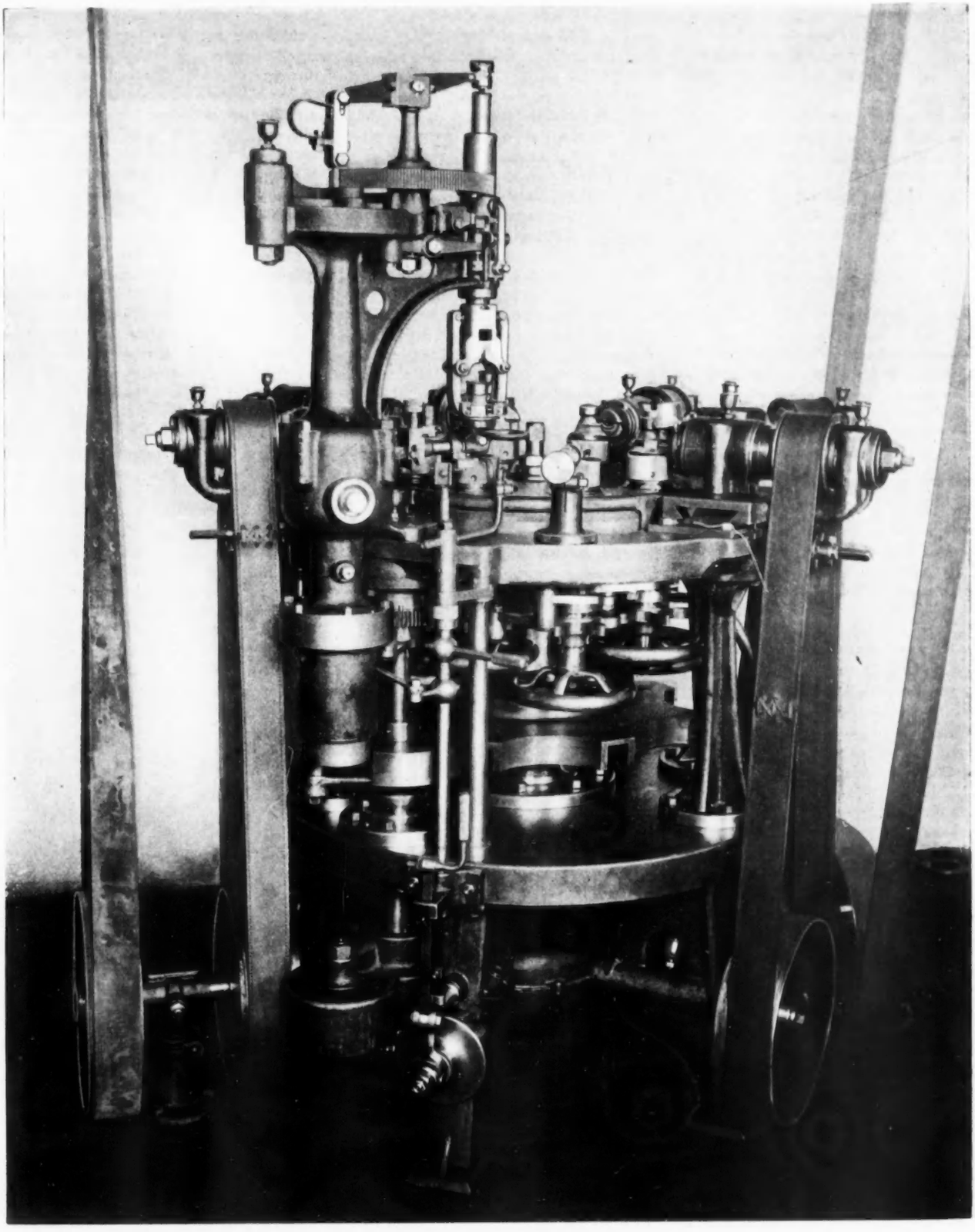
An Automatic Multiple-Spindle Milling Machine.

We illustrate an interesting multiple-spindle automatic milling machine. It is not for the everyday use of the general machinist, but for special work in factories where great numbers of similar parts are produced. Its only duty is for milling hexagon faces which occur especially on brass valve work, and of these it is capable of doing three thousand per day of ten hours. At this rate, five per minute, it is evident that the attendant can do little more than successively and continuously put the pieces in the machine, and this is, in fact, all that is required, as everything else the machine does automatically.



HORIZONTAL BROACHING MACHINE.

An intermittently revolving table carries eight similar vertical arbors, upon each of which, as it comes to him, the operator successively places a hub to be milled. There are six horizontal radial



MULTIPLE SPINDLE MILLING MACHINE.

spindles, each carrying a milling cutter on its inner end, the spindles being mounted on carriages which carry them tangentially, each over one face of the piece, and return by a quick movement. One side of each of six pieces, or one complete piece, is thus milled for each movement. As there are eight spindles, while only six are occupied at the same time in the actual milling, two spindles are always in positions, one for the removal of the piece, which is done automatically, and one for placing a new piece in position to be milled. The operator sets the piece so that one flat of the casting coincides with a gage or tool, and the faces are then successively brought to the outside of the circle for milling, by the action of the stars seen above the hand wheels, the latter being used by the operator for turning the piece for the first adjustment of the faces.

It is impossible to describe in detail the entire machine; there are fifteen sheets

of drawings with the patent, but the removing apparatus especially deserves looking at, and is a prominent feature of the machine. In the half-tone it is seen standing above the body of the machine. A pair of jaws are seen immediately over the finished piece. While the milling of the several faces is going on, and all the pieces are for the moment stationary, the jaws descend and clamp the piece; they then revolve backward and unscrew it from the socket which holds it, rise sufficiently for a shelf or bracket to swing under it and receive it, and the automatic tilting of this allows the piece to slide off into a suitable receptacle for the finished work. The machine shown in the half-tone has been running nearly two years, with considerable overtime, and has cost nothing for repairs. The machine was designed and is built by James Gregory, Bridgeport, Conn.

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Cultivation of the Inventive Faculty by the Solution of Constructive Problems.

BY LEICESTER ALLEN.

I have received three other solutions of problem No. 8, two of which I herewith present. The problem is a difficult one, and I am not surprised that it has received fewer solutions than any previously given out. In fact, I think the variety of solutions of which it is susceptible, much fewer than those of any of the previous problems.

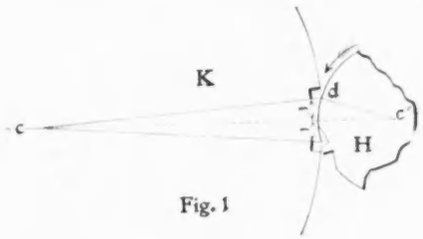

Fig. 1

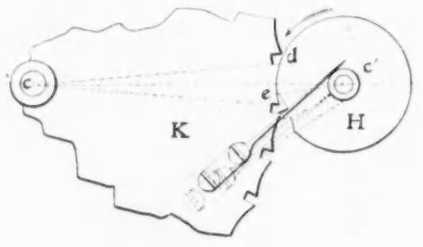

Fig. 2

Some criticisms of Mr. Gribben's ingenious solution, page 130, issue of February 18th, have been made to me personally. They are all directed to the Geneva stop movement *K* and *H*, and to the effect that this movement extended to include thirty-six arcs on the periphery of a single stop-wheel would make the versed sine of half the angle subtended by the arc so small, that there might be a tendency to binding by pressure between the centers of *K* and *H*. When the wheels *H* and *K* are in the full locked position, two radii of wheel *K* including the angle between any two notches, would probably be not more than 6° apart. When wheel *H* starts to rotate in either direction, if the wheel *K* has from any cause been slightly moved forward, the point at the extremity of one of these bounding radii will bear against the periphery of wheel *K*, as shown in Fig. 1, and the angle between the radius *c d* thus bearing, and a line joining the centers *c c* of *H* and *K* would not be more than 4° (probably not more than 3°), which some have thought to be perilously within the angle of repose and liable to create great friction upon the journals of *H* by even a slight contact between the two wheels at the point *d*. Such contact will tend to move both wheels in the direction indicated by the arrow, and the friction so produced will increase the tendency to turn in that manner. I thought this point well taken. My own experience with the Geneva stop movement has not extended beyond the use of more than ten notches or less than 36° pitch from center to center of notches, or about 32° of peripheral face between the notches. This has always worked well; but I can easily see that there must be a practical limit to the number of notches that can be used. I can, I think, see also how this limit may be made to lie beyond, instead of within, 36 notches by a device illustrated in Fig. 2. I have never met with this attachment to a Geneva stop-wheel. I believe it to be original with me. The Geneva stop is a useful movement for some purposes. I hope this addition may widen its field of usefulness.

It consists in a spring (one for each notch in the stop-wheel) attached to the side of the stop-wheel and arranged to bear upon the shaft of the one-toothed drive-wheel with full, or nearly full, tension at the instant the tooth is leaving a notch after having turned the stop-wheel through one of its pitch spaces. The spring will thus bear against the shaft till the one-toothed wheel has rotated round to the position for the engagement of its tooth with another notch, and until this engagement causes another movement in the stop-wheel; the spring then snaps off from the shaft of the driver, but while this operation has been going on, the spring correlated with the next notch in order of succession has been brought to bear upon the shaft with about its full tension, and so on for each successive movement of the stop-wheel. The action of the spring is to hold apart the extremities of the radii *cd*, *c'd*, and to create pressure between the wheels at *e*, Fig. 2. The latter, however, will be somewhat relieved by the motion of *H*, instead of increasing by such motion as pressure at *d* would. The springs should be just strong enough to neutralize any tendency of the stop-wheel to turn. The positions of the spring at different points when the stop-wheel is turned by *H* is shown in dotted outline. Practically, in almost any form of the Geneva-stop some clearance must be allowed, which gives a little backlash to *K*, and a very little forward motion of *K* might cause binding at *d* when so many notches are used, unless some means were adopted to prevent it. A detent pawl might also be used to hold *K* from moving forward, but I can conceive of cases wherein a resort to a ratchet and pawl would not be convenient, and in which the springs above described would be entirely unobjectionable except that it would cost something to make and apply them.

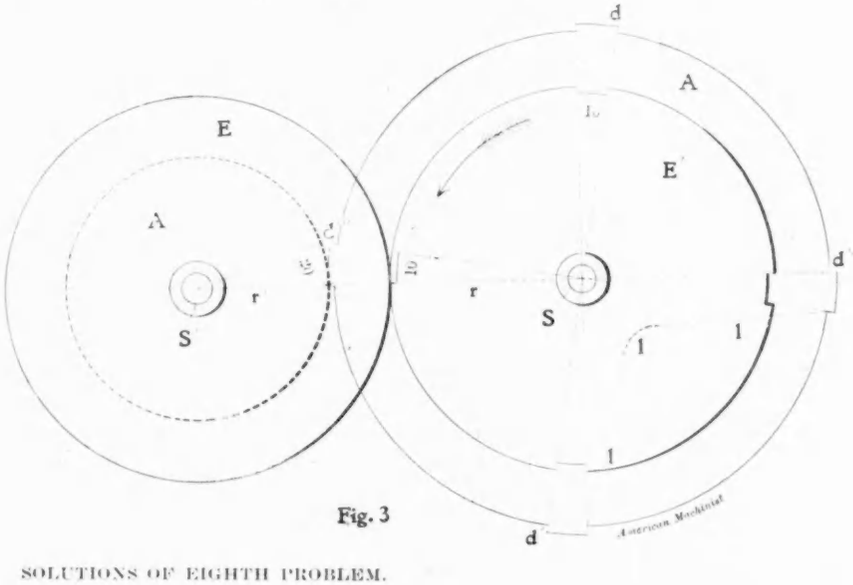

Fig. 3

SOLUTIONS OF EIGHTH PROBLEM.

Mr. J. P. Hayes, of Meriden, Conn., has sent in three solutions of problem No. 8. I regret to say that the first of these solutions is not sketched and explained with sufficient clearness to render its compre-

hension easy. The second solution, which would be operative as required only for light gearing and very slow movement, is shown in Fig. 3.

In this movement E and E' are friction wheels, E' being the driver. To the side, or to the shaft, of E is attached another and smaller friction wheel A, shown in dotted outline. The friction driver E' is notched at four points (90 degrees center to center), the width of these notches at periphery being 10 degrees. To the side, or to the shaft, of E' is attached a disk A, having projections from its periphery placed 90 degrees from each other, center to center, and having 10 degrees of arc at their outer faces. The radius r from the center of A to the outer face of any of the

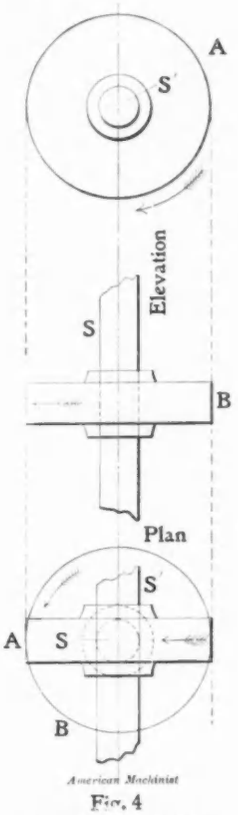

Fig. 4

NINTH PROBLEM.

projections, is twice that of the radius r' of the wheel A; hence any of the projections, acting against the periphery of A', will, while moving through an arc of 10 degrees, move A' through an arc of 20 degrees. So long as E' acts upon E, the motions of E' and E will be uniform; but it will be seen that the 10-degree notches in E' are arranged to leave E free from contact with E' precisely at the instant a projection on A comes in contact with A'. E is fast on the shaft S', and therefore will, theoretically, move through an arc of 20 degrees, while E describes 10 degrees. At the end of this movement, E' again engages E directly till the next projection on A comes to position for acting upon A'; and so on. I have said this would be the theoretical action; practically, unless the motion is so excessively slow that the momentum of the parts is a negligible quantity, there will be slip whenever the engagement is shifted from A to E', or the reverse. This violates the restriction that the action may take place as required at any rate of speed within moderate limits; but, in his third solution, Mr. Hayes makes mutilated gears of A' and E' by forming them with teeth upon the portions of their peripheries, shown in Fig. 3 as friction surfaces. This construction would make the action positive, but would require nice workmanship. In the friction movement, the wheel A could be lightened by cutting away the metal on the dotted line lll, as proposed by Mr. Hayes; but there would still remain enough weight to make the momentum a factor in the movement at any but a very slow velocity.

Mr. H. J. Kennedy, of Sparrow's Point, Md., has contributed a solution substantially identical with that of Mr. Hayes.

I have now presented all the acceptable solutions of this problem that I have received, and, with the editor's permission, will now give out:

PROBLEM NO. 9.

The geometrical axes of rotation of the shafts S and S', Fig. 4, intersect at right angles. These shafts, respectively, carry disks B and A, each fast to its shaft and rotating in a plane at right angles with the other. It is required to make one disk drive the other at uniform and equal angular velocity with the driver, without using a belt or any other flexible connection, without trundle wheels, or gears having teeth set at an angle with the plane of rotation, without any change in the relation of angularity between the said axes and planes of rotation, and while continuously maintaining the intersection of the geometrical axes of the shafts, that is to say, the indefinitely extended axes of rotation of the shafts.

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Repairs of Electrical Machinery—Field Coils—III.

BY A. R. HARRIS.

As stated in previous articles, field coils are rendered useless either through injury received from external causes, from overheating due to an excessive current, or through short circuits caused, in most cases, by oil which works its way into the coil. Clean oil is not a conductor of electricity, and, of itself, could not do any damage; but that which finds its way into the coils comes from the bearings of the machine and is full of metal ground away from the surface of the bearings and the shaft. When this oil begins to penetrate the coil it will not have any immediate effect, because it will not connect points, in the coil, that are separated by a sufficient distance to make the difference in the pressure of the current enough to cause it to jump across the intervening space; but in time the oil will work its way further into the body of the coil, and then points will be connected between which the pressure is such that the current will jump. Just how this action occurs can be illustrated by a comparison with water flowing in a pipe. Suppose we have a pipe that runs along for a distance of, say, 100 feet, and at that distance it is bent around, by means of a U-connection, so as to return to the starting-point, the outgoing and the incoming pipes being placed side by side. If at a point near the bend, say 3 inches, a small pipe, one-eighth of an inch, is inserted so as to connect the outgoing and incoming pipes, only a small amount of water will flow through it, as the length of the main pipe that the short cut would cut off would not be sufficient to make the path much easier by one route than by the other. If, however, the small cross-connection is placed, say, 80 feet from the bend, a considerable amount of water will flow through it; for then, by taking the short cut, the resistance of 160 feet of the main pipe can be saved. The water would flow through this small pipe so fast that a considerable amount of heat would be generated, by the friction of its passage through the contracted opening, and if it were possible to confine this heat at the spot, there would be a considerable rise in temperature. This, however, is not possible in the case of water, because the water itself carries away the heat.

The action of a short circuit in an electric conductor is precisely the same as that described above, but as the wire is covered with an insulating material which is a non-conductor of heat, and as the electric current does not carry the heat away with it as does the water, there is a rise of temperature at the point where the short circuit occurs. If the short-circuited points are so near to each other that the current that leaks through is very small, the heat generated will be so slight that there will be no perceptible rise in temperature, the conduction and radiation being sufficient to keep the temperature down to about the normal. If, however, the short-circuited points are at a great enough distance from each other, the current that will pass through the short cut will be much greater, and when the distance between the short-circuited points becomes sufficient, the current passing by that path will be enough to heat the insulation to a point where it will begin to char. When this occurs, the current will begin to increase very rapidly, because the insulation, by being charred, becomes a better conductor. As more current passes, more heat is generated, and, therefore, the temperature rises more, and soon reaches a point where the wire becomes red-hot. When this stage is reached, the insulation is converted into a very good conductor, and as a result nearly all the current in the circuit will pass by the short-circuit path, and the development of heat will be so great

that a part of the insulation, and the metal of the wire, will be converted into vapor, and, by the expansive force, will cause an explosion which will burst through the surface of the coil. The action will continue until the ends of the wires are fused together so as to form a complete metallic path for the current, or until the gaps between the ends become so great that the pressure of the current is no longer able to span them; then the current will break. If this action took place gradually from beginning to end, it would be possible to avert serious damage, as the insulation would give out an odor of burning varnish as soon as it became overheated; but when the operation has progressed to this stage, the reduction in the resistance of the short circuit becomes so rapid, and the increase in strength of current so great, that the balance of the action takes place in a very few seconds; hence, there is practically no warning of the impending disaster.

The points where burn-outs are the most likely to occur are the ends of the coil. There are two reasons for this, one that there is more probability of being an opening between the wire and the end of the coil through which the oil may penetrate, and the other that a greater length of wire can be included in the short circuit at the ends.

Fig. 1 shows the general appearance of a "blow-out," as it is called, caused by a short circuit. To repair an injury of this character, permanently, the best course to pursue is to rewind the coil; but in some cases the amount of wire that has been rendered useless is so small that it will be more economical to simply replace the damaged part. The way of doing this can be explained in connection with Fig. 2.

The first thing to do is to remove the damaged wire, leaving the perfect part with a slope, as shown at *E*, of sufficient inclination to prevent the wire from falling into the space from which the imperfect part has been removed. For each layer of wire there will be two ends, as shown at *C D*. If the insulation at the bottom or the end of the spool has been damaged by the burn-out, it must be scraped away and be replaced by new insulation. This having been done, the next step is to connect the ends *C D* of the remaining wire so as to form a continuous piece. To do this, find the end of the bottom layer, which can be done by attaching one wire from a magneto-bell to the end *B*, and connecting the other wire with the ends coming from the slope *E*, until one is found that will ring the bell. This end will come from, say, the side *C*, and must be soldered to an end coming from the side *D*. Then test with the bell for another end on the side *C*, and connect this with a second end on the side *D*. Proceed in this way until all the ends have been connected with the exception of the one belonging to *A* and one other.

All these connections must be well covered with insulating material, so that there may be no danger of the wire in one connection coming in contact with that of any other. The insulating should be made as neatly as possible, so as to not take up any unnecessary room. The ends of the wire should be tinned first, and the acid used for the purpose should be washed off thoroughly, and all that part of the wire that will not be connected by solder when the joint is made should be varnished over, to prevent any acid that may remain from spreading. All this having been done, an additional insulating covering should be spread over the several soldered joints, and then the remaining end that does not belong to *A*, and which should ring with *B*, is to be soldered to the end of the new wire that is to be used to fill the vacant space. Having made this connection, wind the wire in layers, in the direction indicated by the wind of the end to which the new wire is attached. Wind the wire in layers commencing at the bottom of the space, and when the last layer is reached, solder the wire to the remaining end, which will be the opposite end of the wire to which *A* belongs.

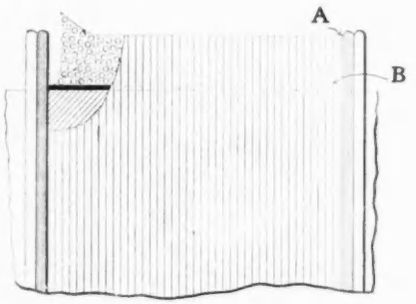

Fig. 1

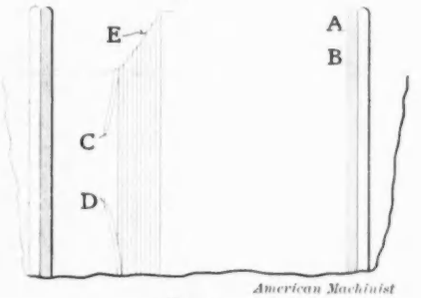

Fig. 2

If it is desired to make a neat-looking job of a repair of this kind, remove the outer layer, of which *A* forms the end, and wind the last layer of new wire over the whole surface of the coil. In this way the patching-up of the coil will not be noticed, as the entire outside layer will be new. By resorting to this process it will not be possible to get as many turns on the coil as it originally had, unless an extra layer is added, because the space taken up by the soldered connections along the slope *E* will be quite considerable, even if the work is done neatly; but there is always room for one more layer; therefore by adding it the proper number of turns can be obtained.

As it takes some time to do a job of this kind, it follows that it will not be advisable, unless the coil is large, or the time required to do the work, for one reason or another, is not very valuable.

Many manufacturers wind the field coils in a way that is not very mechanical. The inner end is brought to the surface through an opening in the flange at the end of the coil, or through a groove in the insulation, and being only a frail wire, is very liable to be broken off, unless handled with an amount of care that is not to be counted upon in connection with a large piece of machinery. In some cases the construction is improved, somewhat, by soldering the inside end to a wire of much larger size and carrying this to the surface; but even this is not very reliable. The best arrangement for this purpose is that shown in Figs. 3 and 4. As will be seen, the end-piece is simply a strip of sheet brass, which is set into the end insulation and passes down and under the bottom of the coil for some distance. Several turns of the first layer of wire are soldered to this strip, and then these connections, as well as the

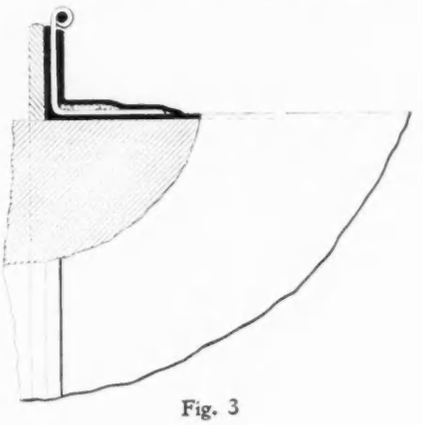

Fig. 3

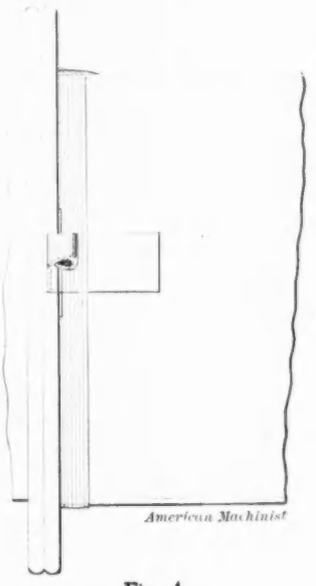

Fig. 4

REPAIRING FIELD COILS.

strip itself, are well covered with insulating material, as clearly shown in Fig. 3. This construction is very strong, because the strip cannot move sidewise unless the insulation moves, as it is set in a recess in the latter, and it cannot move in any other direction because the wire holds it. It cannot cut into the wire if the insulation over it is of a strong kind, say "fiber," and of sufficient thickness; and the outside curled-up end cannot break off unless it is very weak.

Whenever it becomes necessary to rewind a coil, if it is not provided with a thoroughly substantial terminal, this style should be used, as it is about as good as any, and very easily made. It is very important to make the inside end strong enough to withstand very hard usage, because if it should happen to break off, the whole coil would have to be rewound. It is on this account that so much stress has been laid upon the point here.

When it is desired to repair a coil in a hurry, it can be done by connecting all the ends on the slope *E*, Fig. 2, and without waiting to fill up the vacant space with new wire. If the brushes should spark when the machine is started up, the difficulty can be remedied, in part, if not wholly, by placing in the space from which the damaged wire has been removed, a number of turns of wire as large as that used for the series coils, and passing the whole current of the machine through it, care being taken that the direction of the current is the same as in the shunt coil. The number of turns of this large wire required to reduce the sparking to the lowest point can be ascertained best by actual trial.

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A Handy Upright Drill.

We illustrate a little upright drill possessing many interesting and novel features, most of which will be evident to our shop readers upon an inspection of the half-tone. The side of the drill is shown. The horizontal shaft is driven by a belt from the line, and runs continually. The drilling spindle runs only when drilling. All the motions of the drill are controlled by the single lever shown. The lever moves forward and backward, and also sidewise. The forward movement puts the spindle in motion, and also feeds the drill down by the usual rack-and-pinion movement. Moving the same lever sidewise moves the friction wheel in or out on the face of the disk, and changes the speed of the drill as required. The drill is provided with a four-armed revolving table, one arm carrying the regular plate, another a self-centering vise, and the others, or indeed all the arms, may be fitted with jigs, or chucks, or any special attachments that may be required. The drill is intended for drilling from 0 to ⅜ inch, and swings 15½ inches. It weighs 250 pounds, and is made by W. W. Flickinger, Cochranton, Pa.

Wood Pulley Litigation.

With a United States patent covering a very simple feature of a common article of manufacture as a basis, the successful development of an extensive business involves unflagging perseverance and the seizing of every opportunity of advantage. Recent patent litigation brings to light some interesting facts in connection with the wood split pulley business.

A HANDY UPRIGHT DRILL.

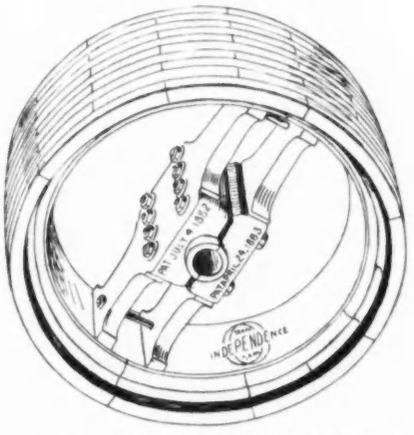

Fig. 1. THE DODGE PULLEY.

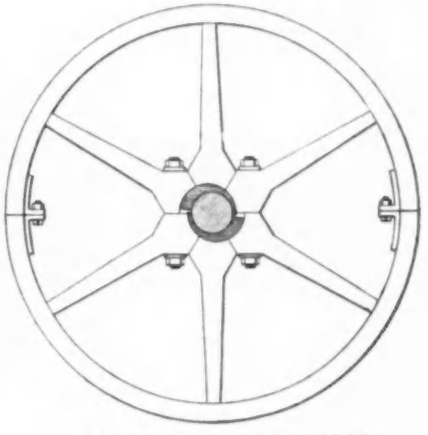

Fig. 2. THE GILBERT PULLEY.

In 1882 Dodge and Philion obtained a patent on a split pulley having the ends of the rim touching while the halves of the hub were not in contact and with a changeable split bushing to adapt same pulley to shafts of various sizes. Fig. 1 shows the well-known Dodge split pulley.

Probably no one living has the slightest idea as to when the first iron split pulley was made; but every machinist knows they are common enough, and they certainly date back farther than the oldest hand can remember. The pulleys are usually cast whole and split apart before boring and turning. The rim must of course always come together, while it is a very common, if not the general practice, to chip away the edges of the hub so that they will not touch, and split bushes are used wherever necessary to suit the size of the shaft. In some cases keys or setscrews are used to help to secure the pulley to the shaft, but in other cases only the friction of the surfaces has been relied upon to hold the pulley securely.

Upon the face of it, the Dodge and Philion patent of 1882 would seem to have been a very precarious one from the beginning; but it has been industriously and quite successfully used, several makers of competing pulleys having been led to compromise with the Dodge company. The Dodge company even went so far as to attack the Saginaw Manufacturing Company, makers of the Gilbert pulley (Fig. 2). Suits were commenced against three of the customers of the latter company, the defense of which suits has been assumed by the company. A decision has been given, at Cincinnati, that the Gilbert pulley does not infringe upon the Dodge patents. The Saginaw company makes the claim that no decision has been made in any court that the Gilbert pulley in any way is an infringement upon the Dodge patent, and states that it will defend any suits which may be brought on account of the use or sale of its pulley, paying all costs and all final judgments, if any, that may be rendered. Quite an interesting collection of testimony has been made, from machine shop experts all over the country, showing how pulleys embracing the essential features claimed under the Dodge and Philion patent have been used for a generation.

Letters from Practical Men.

Computation of Strength per Square Inch in Comparing Relative Strength of Foundry Mixtures of Iron.

Editor American Machinist:

It is evident by the review of "Metallurgy of Cast Iron" in your issue of March 25th, that the reviewer of my late work has misunderstood the meaning and the purpose of the term "strength per square inch," and formula given for obtaining the same. The first paragraph on page 461 clearly defines that the method advanced for determining the strength of test bars is only to be used in cases where test bars are rested on bearing blocks the same distance apart, having whatever one cross-section or area anyone might adopt for the purpose of making comparisons in the relative strength of foundry mixtures of iron, and thus cannot give the ridiculous results claimed by the review. The formula given on page 463 is of a character all can understand, especially the men that stand to-day in greatest need of noting the difference that is sure to exist in the area of test bars that are cast from off any one proper sized pattern. The writer did not adopt his formula given, until after considerable research and study of this subject, and believes that, for the purpose intended, it is as correct and simple, if not more so than any existing at the present day.

THOS. D. WEST.

[It is true that in the opening paragraps of chapter LXI, Mr. West indicates that his method is to be employed for comparative purposes only, but it is impossible to read other paragraphs without concluding that he thinks he is obtaining absolute results. Thus in the paragraph at the bottom of page 462 we find: "The author could never perceive wherein the formula used for figuring the strength per square inch, as advanced in our text-books, etc., had any bearing on the actual area of a test bar and the load at which it broke." Immediately following this appears his method of calculating the strength per square inch of bars in flexure, which consists simply of dividing the breaking load by the area of the section, and he actually gives in his tables the strength per square inch of bars of different sections calculated in this way—both method and results being fairly characterized by the word ridiculous. It is impossible to conclude from other portions of the book, such as page 464, otherwise than that Mr. West entirely fails to comprehend the principles which lie at the foundation of calculations of the stress in beams, and that he thinks he is advocating a better method of doing that work. If he does not mean this his work is meaningless, and if he does mean it the work is wrong.

Mr. West has done excellent work in advancing the practice of the founder's art, the numerous articles which we have published from his pen in the past being sufficient evidence of the value which we set upon his writings when they are confined to fields in which he has knowledge. It is by no means a pleasant task to write in this way regarding his latest book, but if the truth is to be told it is impossible to do otherwise.—Ed.]

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Safety-Valve Practice.

Editor American Machinist:

It is rather a good thing that my innocent enough communication in your issue of March 11th has stirred up some discussion on the safety-valve question. It needs it. I object, however, to being misquoted all the way through.

In the first place, it seems to me that it would be rather evident to anyone who read my communication, that I was not trying to set up a rule scientifically exact for the determination of the proper area of a safety valve under any and every condition and circumstance, but rather to suggest an improvement in present practice, which suggestion might possibly lead to such a discussion of the subject as might bring out something that would, in a way, be satisfactory, if not agreeable, to all.

There is not, I should hope, an engineering schoolboy in the land who does not know that, exactly speaking, the question of pressure enters into the problem, and certainly he will be no more than a schoolboy before he finds out that in practice, and, I quote from what I wrote before, "within the limits of pressures ordinarily employed," the average boilermaker—the man who makes the boilers we use, and stand around, and walk over, live with us as it were—will never make calculations involving a quarter of an inch, more or less, area of safety valve, and little blame to him for not doing so. The thought in my mind was the suggestion of something that required no calculations that an ordinary schoolboy, not very far advanced, could not make and understand, and that should have the merit of insuring safety.

I said I objected to being misquoted. Mr. Harrison, in his communication of April 22d, starts by remarking that I give some "authority" for saying "pounds of water evaporated per hour multiplied by .0055, which gives the nominal area of valve in square inches for all reasonable pressures." In regard to this, I did not try to saddle anything I said upon any "authority" whatsoever, and further, it does not stand to reason that I said anything about "nominal" area or "reasonable" pressures. Immediately after this, Mr. Harrison sets me up as repudiating this rule which he accuses me of giving on "authority" by proposing two 3-inch valves for 25 feet grate surface. I said two 3½-inch valves would be a trifle small, but might be trusted, and, as usual in such matters, the "American Machinist" brought out the numerals very distinctly.

Mr. Harrison says, referring to the fact that the steamboat inspectors give a preference of 3 to 2 in area of valve in favor of pop valves, "The apparent assumption that the pop valve has a greater actual discharge area than the lever and weight valve is untrue." Perhaps so, but I always believed differently. In the early days of the pop valve I have frequently substituted a pop valve for a lever and weight valve twice its area. The former always relieved the pressure, which the latter had failed to do. I never measured the lift. There did not seem to be any occasion for doing so. Later on a committee of the Board of Supervising Inspectors of Steamboats investigated the matter very thoroughly. In the test instituted, several pop valves were put in competition with two lever and weight valves made under the supervision of the committee. These last named valves were made in a very superior manner—swinging fulcrum, with hardened knife-edge connections, and no obstruction whatsoever to the free escape of steam. As is well known, in the instance of the pop valve there is obstruction. Comparing the behavior of one of these with two pop valves of the same area, the pressure could not be increased after either of the pop valves commenced blowing, while it was increased 5¼ pounds after the committee's valve began to blow. The area of opening of one of the pop valves was 1.231 inch; of the other, 1.427 inch. The area of opening of the committee's valve was .633 inch.

F. F. HEMENWAY.

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Safety-Valve Practice.

Editor American Machinist:

The formulas for safety valves which have recently appeared in your columns, in which the diameter of the valve is made to depend on the area of the grate surface, are all wrong. In your issue of May 24, 1894, I gave examples showing the absurdity of all rules for safety valves in which the grate surface is taken as a basis for calculation; and my "Mechanical Engineers' Pocket Book," page 722, contains a revision of the article. Of two boilers, each generating the same quantity of steam at the same pressure, one may have a grate surface four times the area of another, one burning 10 pounds of coal per square foot grate per hour, and the other 40 pounds (a not unusual practice in the West). The safety valves should be the same for the two boilers, since they are of the same power; but if the grate-surface rule is used in calculating them, one will have twice the diameter of the other.

WM. KENT.

Shade Lines on Drawings.

Editor American Machinist.

I have been waiting to hear someone say just what R. D. Hawkins did, in your issue of April 8th, about shade-lining the bottom side of a cylinder or, in fact, any curved surface which passes beyond the line of sight.

Mr. Halsey asks how Mr. Hawkins' cylinder, Fig. 2 and 2*a*, can be distinguished from the object shown at Fig. 4. If the latter were mine I should shade it thus: The shade line at *c c*, because a surface falls back at a sharp angle from the surface of the paper; and no shade line at *d d*, because there being a sharp angle there only, there is nothing to be shaded.

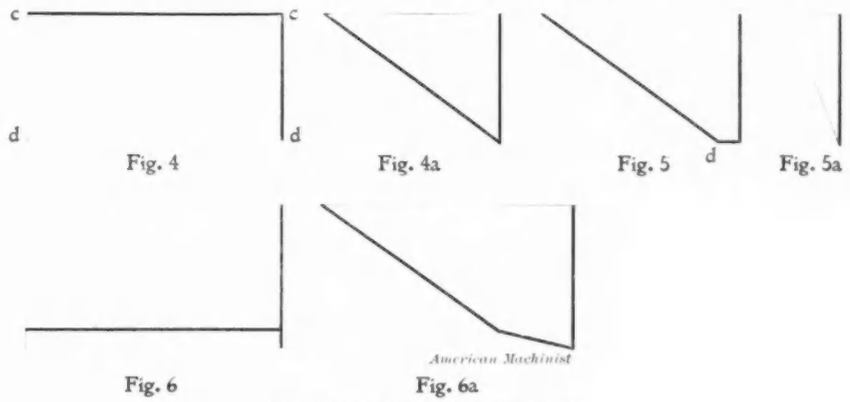


Fig. 4 Fig. 4a Fig. 5 Fig. 5a

Fig. 6 Fig. 6a

SHADE LINES ON DRAWINGS.

Were Fig. 4 *a* made like Fig. 5, then I would put a shade line at *d d*, because there is an appreciable surface beyond the angle—whether on the neutral line, as Fig. 5, or in sight, as Fig. 6 and 6 *a*.

Of course, none of these devices will do away with an end view of the object in question; but where members having various surfaces are grouped on a drawing, such methods help the mechanic's mental vision to separate those parts having curved outlines, etc., from the others, and anything which assists in reading a drawing, even in a slight degree, is worth making use of.

W. P. CANNING.

Lowell, Mass.

[Mr. Canning gives a new reason why the bottom line of Fig. 4 should be made light—the end view being as in Fig. 4 *a*—because "there is a sharp angle there." Make the angle still sharper, as in Fig. 5 *a*, and his reason still holds; but I doubt if he would follow the same practice, and certainly very few others would. The only reason for making the bottom line of Fig. 4 light for an end view like Fig 4 *a*, is the same as for a cylinder—because it casts no shadow—and the same reason applies to section 5 as well as to 4 *a*. The distinction between Figs. 4 *a* and 5 is a new one to me; and while Mr. Canning appears to approve the practice of Mr. Hawkins with a horizontal cylinder, in making the bottom line light, he is inconsistent in making the bottom line of Fig. 4 heavy for a section like Fig. 5, for the argument is the same for both. I cannot see that the "appreciable surface beyond the angle" in Fig. 5 has anything to do with the matter from my point of view. I do not believe that any workman would be helped by the heavy top lines of Figs. 4 and 6, or by making the bottom line of Fig. 4 light for a section like Fig. 4 *a* and heavy for Fig. 5.

The letters by Mr. Hawkins and Mr. Canning illustrate the hopeless confusion to which the light and shade standpoint lead. Both attempt to show too much, and the result is such complexity and confusion that nothing is shown with certainty. —F. A. H.]

▲ ▲ ▲

Uncertain Pulley Practice.

Editor American Machinist:

Do any of your readers have trouble when putting up shafting, with getting machines to run as they have figured?

The writer had a case where he had figured on driving two alternators from a line shaft.

Alternators must run at the same speed, or the alternations get mixed, and when the electrician came to start up he could not get them to synchronize at all. The line shaft ran 300 revolutions and the machines 900, but there were 7 revolutions difference.

I measured the dynamo pulleys, and one of them was an eighth of an inch too large, and said, There is your trouble, this pulley is too large, and this machine runs too slow. He replied that that was the machine that ran too fast, and we had to build the pulley up still larger.

Another case where it was intended to run two alternating dynamos together, and where the case was more complicated, as there were two line shafts; the machines are fifteen revolutions apart. Measuring the pulleys shows that the pulley driving the shaft for one dynamo is three-fourths of an inch too large, and the pulley driving the other one is one-fourth of an inch too small.

Another thing that shows up is that there is no standard for crowning pulleys, and the crowns must govern the speed. Measuring the crown of a dozen pulleys with 10-inch faces, the pulleys all made at the same time, by the same firm, showed crowns varying from 1-16 to 3-16 inch in the 10-inch, and there were no two alike.

Inquiry of a pulley maker as to the plan pursued to get machines to run exactly as figured, and also the plan for crowning and the point in the crown that was measured for the diameter, brought out that the procedure is something like this: Shafting makers do not get pay enough to measure pulleys; they are taken to the turning mill and enough cuts taken off to get a good face.

If the pulley is rapped pretty well in molding it will be a little large, and if the rim comes out true, and no sand-holes, it will require but little turning, and the pulley will be large.

If the rim comes out a little crooked, and there are sand-holes, it will be made small. If it should so happen that this pulley was rapped very little in the sand, there would be a great difference in the size of the two pulleys; and as they are not measured, the purchaser will wonder why he cannot figure closer.

In the matter of crowning, that is left to the judgment of the man doing the job, which accounts for so many different sizes and shapes of crowns.

An uncle of the writer some years ago used to build machines that had pulleys about 15-inch diameter and 12-inch face. He had an iron put in the proper shape that he put on the ways, the end against the lathe head. The screw in end of tool stock ran over this iron, and he got a round crown; they were all alike, and the diameters were all alike.

There should be some standard for crowns, and also pulleys should be made of the diameter called for.

W. E. CRANE.

Waterbury, Conn.

▲ ▲ ▲

"Shop Prisons."

Editor American Machinist:

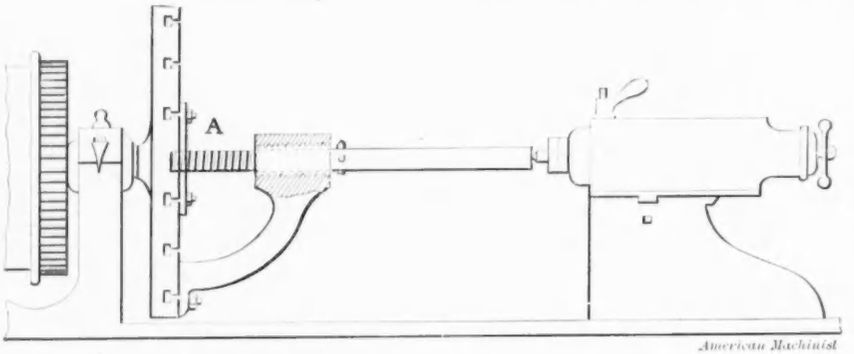
Your recent editorial about "Shop Prisons" interested me considerably. I am happy to believe that we don't have many of that kind of shops. I have known a good many shops at one time and another, and I never struck a regular out-and-out prison shop, although I have heard of them. The only way to do with such a shop must be as you suggest, to let them alone and to get as far away from them as possible. The proprietors and the foremen who believe in running a shop in that way can't learn anything, and there is no use trying to teach them. Men of that kind would need to be reconstructed upon an entirely different design before they would be of any use in connection with a machine shop.

Employers, or, more frequently, shop foremen, are sometimes troubled with boys who are put to learn the trade and

who seem to be entirely lacking in mechanical instinct. It seems to be impossible to get a mechanical idea into one of them. This thing works both ways, and, unfortunately, works badly both ways. Men and boys in the shop are sometimes troubled with persons in authority over them who also are lacking in common sense, which, I take it, is the highest development of mechanical instinct and most peculiarly adaptable to the control of human nature, which is the most complicated of known mechanisms.

"Profitable communicativeness" has done much in promoting the general supremacy of the American mechanic. But behind the freedom of the shop to outsiders there has also been wide freedom allowed to the men in the shop, and communicativeness has been nowhere more profitable than in the suggestive and stimulating intercourse of man with man. I would be the last to suggest the abolition of proper discipline. Each man should have his place and should be in his place, but if he is to be run up to speed without heating or friction there should not be too tight a fit. Friction is as fatal to the human machine as to any other.

TECUMSEH SWIFT.



THREAD CUTTING WITHOUT A LEAD SCREW.

Thread-Cutting in the Lathe Without a Lead Screw.

Editor American Machinist:

I happened in a shop and saw a lathe hand doing a job, and have something to say on "How a job was done, and how it might have been done." The workman was given six castings, as shown in sketch, to be bored out and tapped eight threads to the inch, 2½ inches diameter, with orders to clamp it to the face-plate, bore it out, and start a tap; finishing it in the vise. The only lathe in the shop large enough to swing it was without a lead screw, and the casting not strong enough to run the tap (made for the job) through. The job was finished as ordered, and then came a job to file them over to get them in line, as the tap did not go straight through. This job might have done as the sketch shows—a piece of iron or steel clamped to the face-plate, and tapped out same thread as the one to be cut. Then by the use of a bar with a dog on one end and threaded on the other, and a cutter ground to a thread tool, I believe the job could have been done better, quicker and easier.

A BRASS FINISHER.

▲ ▲ ▲

Planer Finishing Tool.

Editor American Machinist:

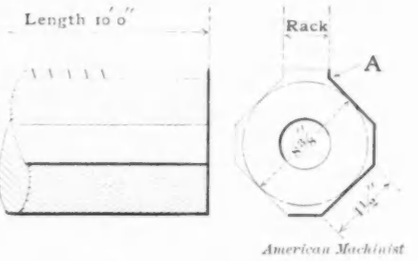
Mr. Quirk, in your issue of April 8th, has objected to my statement regarding the planer finishing tool, as published in the issue of March 11th, viz., "It works well without the aid of a lubricant or cutting solution," and states that it "requires some qualification." The inclosed sketch of the Niles boring mill bar is almost as good an illustration as I can think of to qualify the statement. This special bar is a steel forging (note the dimensions) giving a finishing area on one flat of 540 square inches, over which this tool passed without being removed for sharpening, and no thin shims were used. In fact, there is only one time when such expedient is thought necessary; that is to bring the rear cutting edge of the tool to the work in reaching into the corner *A*, shown on end view; in that way the finish is brought up very close.

The finish required on these bars is such that no better can be given, as they are scraped accurately to bearing, and, occupying the front position on the boring mill, are, as usual, finished by "spotting" under the hand scraper. Steel bars take on a much better "spotting finish," being of a much denser material, and not having the minute holes usual with cast iron.

As for using soapsuds or any cutting solution, a few drops of rain from a leak overhead fell, unintentionally, of course, in the path of this tool while at work finishing a smaller size steel bar, and the planer hand remarked to me, in answer to my query, "That was the only time I have had to use any cutting solution, and it has rather spoiled the looks of my finish." Suds or soda water will give that "mirror-like finish to the work," but that is not desirable on work requiring such great accuracy in bearing surfaces as the bar referred to.

Judging from Mr. Quirk's method of grinding "perfectly straight," I am led to believe he is obtaining a coarser feed finish than is customary here; but on engine work, stub ends of connecting rods, etc., when the aim is to obtain a finish, mirror-like, and not a true bearing, I think the cutting solution is necessary and helpful; while in the case of the boring bar, we believe it could not be finished as desired with such aids.

To compare feeds, I would state that an ⅛-inch feed has been used, but as a rule it is much less, probably 1-16 and under,



WORK OF PLANER FINISHING TOOL.

which gives an ideal finish, smooth, without the mirror appearance, and true; for this the tool is slightly rounded, and usually set vertical without reference to incline to or from the cut. In regard to chattering, such is not the experience at the Niles Works, and is no doubt due to the coarser feed finish with the water applied.

I am pleased to note Mr. Quirk's remarks regarding my attempt to make this tool in "form and action so clear" to your readers, and also the high esteem in which he holds it. The article has brought to me several inquiries asking more information, as "I don't catch on to the shape." In answer to which I have had made several full-size models in wood and sent them, with this additional information, which I ought to have given through your columns. The tool, as shown for direction by the arrows, is for right-hand finish—that is, from the operator—and cannot be reversed, two tools being necessary when, as is often the case, the finish is also required toward the operator. Then, following the "conditions essential to success," as given by Mr. Quirk, which are very clear, and a little experimenting will give the satisfactory results.

I am surprised at the small percentage, "one person in ten," which Mr. Quirk allows of those who will succeed. I quote from one who has sent me word of his success: "Acknowledging the receipt of your letter and model. I had a tool made like it, and it worked splendid," etc.

I hope this may prove of some help to those who have been interested in the remarks of Mr. Quirk and myself. The tool and its work have, I think, been fully described; and of its chips, it is very apparent that Mr. Tecumseh Swift, writing in the issue of February 11th, was not aware of this planer tool, which, so far as

I know, is the only one capable of making the helical rolled chip, and generally the full length of the work.

WM. PILTON.

Hamilton, O.

▲ ▲ ▲

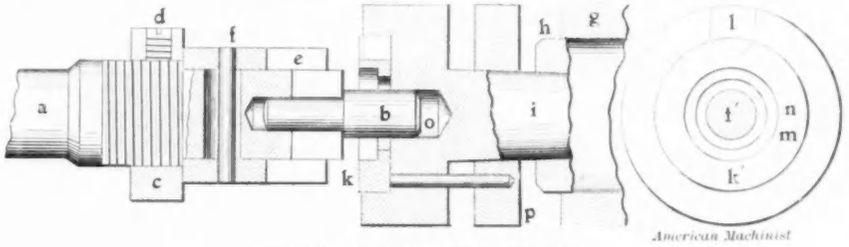
Brass Counterboring.

Editor American Machinist:

A steel pin does not run very well in brass, and so a counterbore used in cutting the same works much better, I find, when made as shown in the accompanying Fig. 1.

To anyone who might feel disposed to criticise this tool on the score of expensiveness, I will say, it would not pay to make it for one hole; but I made it for 30,000 to start with, and consider it cheap.

Where a great number of pieces of work are to be made by inexperienced hands, I have found that when a tool can be made to know more than the person using it, at a reasonable cost, it is the



COUNTERBORE FOR BRASS

cheapest. This is one of that kind, and consists of a three or four lipped cutter *a* with a straight or taper shank as desired, and provided with a tit or guide-pin *b*, driven in or soldered.

A nut *c* runs where *a* is threaded, for adjustment, and is furnished with a set-screw *d* to secure it in position. The sleeve or collar *e* (hardened) slides on the counterbore *a*, with pin *f* fast in it, and loose in the slot in *a*, and stops against the nut *c*. This collar has openings in the end corresponding to those in the counterbore and opposite the same, for clearance of chips. The pin *f* permits it to slide on *a*, as the latter is sharpened, without turning around or loosening the nut *c*. Between the spaces on the end this collar has smooth, flat places with corners rounded off so as not to cut the brass; and they gage the depth of the cut by coming against the face of the work.

The tail-stock of the drill lathe is shown at *g* and the spindle at *h*; and this spindle for this work, and a great deal more like it, should be used with a lever handle similar to that on a screw machine.

The fixture *i* for holding the work *k*, which in this instance had a V-shaped notch in its rim, can be hardened or provided with a hardened bushing for *b* to run in. The point *l* is soldered or riveted into *i* to prevent *k* from turning. So instead of using the hole *m* in the brass for *b* to run in while cutting *n*, the hole *o* in *i* is used, and the smoothest kind of results obtained.

The collar *p* passing three pins through *i* as it strikes the tail-stock *g* when *h* is drawn back, pushes the work out. The holder can be modified to suit other work, and the same principle applied to good advantage. This tool cuts and cuts, and only requires adjusting as it dulls and needs sharpening, and the boy using it promises to run it in his sleep after a time.

A. H. CLEAVES.

Chicago, Ill.

▲ ▲ ▲

Use of Cast-Iron Bearings in England.

Editor American Machinist:

Your article entitled "Cast Iron Prejudice" opens up an interesting question. In many cases the use of cast iron would seem to be the best practice. Some tool makers over here still believe (with, to them, good reason) that cast iron is a very suitable material for large lathe mandrels, as, if made of sufficiently large diameter for its work, it is very rigid, and the necessarily large diameter reduces chattering of the spindle to vanishing point. In addition, if well oiled, the wearing surfaces are almost proof against wear, and acquire an extremely hard glassy skin which works with a minimum of friction.

It is a rather curious fact that textile machinists seem in some ways more advanced than the tool makers over here. For instance on spinning machinery, machine cut wheels are becoming very prevalent, whereas the tool makers have had to be almost compelled to use cut gear by their customers. Also on looms (about the lowest-priced machine known, considering the work on them) the better-class ones are now made with the crank and tappet shafts bushed with cast iron, the loose pulleys all run on a cast iron bush, and in the case of some looms by Messrs. Robert Hall & Sons, Bury, the crank shafts, connecting rods and pins for working the shuttle race are all cast iron and give every satisfaction in working, renewal of these parts being almost unknown. In cotton spinning machinery also, great use is now being made of cast-iron bushed shafts running in cast-iron bearings with the best results as regards smooth, easy running and durability. On some of the smaller lathes at Messrs. Dobson & Barlow's, Bolton, the lathe mandrels are of cast iron with conical necks running in cast-iron bearings, and, with the adjusting arrangements provided, give every satisfaction as regards easy working, durability and preservation of alignment.

One English firm of emery wheel machine builders always use cast-iron bearings and steel spindles (no babbitt metal being used), and another firm like to use cast-iron bearings with annealed *tool* steel spindles for similar quick-running machines, being of the opinion that tool steel does not "seize" so easily as mild steel. Personally, I always consider this last feature an objectionable characteristic of mild steel. I consider that benefit would result from machine builders reverting to some extent to former practice as regards the use of cast iron for wearing surfaces. Let us have the views of readers of various nationalities, on this subject.

JAMES VOSE.

Manchester, England.

▲ ▲ ▲

Cutting Inside Left-Hand Threads.

Editor American Machinist:

The letter by Mr. Willard D. Vose, and your comments on the same, published in your issue of April 29th, prompt me to add a word in favor of that excellent English tool, the bell chuck, which is not appreciated in this country to one per cent. of its real value. Some time last year I showed some chucks of this kind in your columns. I have had a good many pieces to make with internal left-hand threads very similar to those shown in the figures connected with Mr. Vose's letter. For these pieces I made a bell chuck, with the addition, over common practice, that the hub which screwed upon the lathe spindle was split on one side, and had a pinch bolt by which it was clamped to the lathe spindle. The work was then done by a tool upon the back side, the lathe being run backwards—the pinch bolt preventing the same from unscrewing. Of course, this pinch bolt is not necessarily confined to use on the bell chuck. For those who are determined to use the American style of chuck for all purposes, no matter how unsuitable it may be, it would seem to be an excellent plan to split the hubs of the face plates and supply them with the pinch bolt described. Sooner or later that bolt will be useful with any chuck, as it entirely obviates the unscrewing of the chuck when the lathe is run backward.

C. O. GRIFFIN.

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A fine of $25 has been very properly imposed upon a truckman in this city for hauling steel rails through the streets without taking any precaution to prevent the noise. Such noises have been frequent of late, and have been an intolerable nuisance, and as they are entirely unnecessary and avoidable they cannot be stopped too soon, or if permitted, be punished therefor too severely.

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We have no doubt that our readers will think with us that the most notable article in our present issue is the opening European letter from our editor-in-chief. Mr. Miller's well-known faculties as an observer and reporter of those things which are most interesting and profitable in mechanical lines, will make his letters of interest and value to all who have to do with machinery, upon either the technical or the commercial side. Their bearing upon the present export movement of American machinery is, of course, immediate, and they will be read with interest and profit by all concerned in that movement.

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Machinery and the Laborer.

It seems to come within our province and to be our duty to notice the following recent utterance of Bishop Potter:

"The great causes of the general ill-feeling and uneasiness among the laboring classes in the United States to-day may be divided into two classes—machinery and the manner in which the capitalist looks down upon the men who labor for him. Chief of these two is machinery. It is doing away with intelligence in labor. It is turning the laboring man into a simple idiot. Not long ago I visited a large factory in this State and was much impressed with what I saw. The owner proudly showed me around, pointing out the manner in which labor was simplified. I saw a young man sitting before some sort of a large hammer. He sat with his legs crossed, and all his work consisted in shoving into an opening in the machinery a small piece of iron. He would turn the metal two or three times, throw it into a large box, and take another piece. That was this man's work, day after day, week after week. No wonder that at nighttime he drank, gambled and fought. He had to; otherwise he would go mad. How many of us would stand this and not cry out? Not one of us but would become a striker. Myself among the first."

We have profound respect for Bishop Potter and absolute faith in the purity of his motives. We admire the frankness of his utterance as quoted above; its sincerity is self-evident, and we think that the good bishop did well to say it. If these things are thought, as we know they widely are, the worst that could occur would be that they should be cherished in secret. Correct thought does not exist without free speech.

We believe, we can say that we know, that the bishop is entirely mistaken. The operation and effect of machinery upon the toilers most intimately associated with it is precisely the reverse of that assumed. The hewer of wood and the drawer of water, the typical and universal drudge of old, has disappeared from civilized life. Steam drives the pump and the saw. We do not know what operation of the factory Bishop Potter happened to witness. It may have required more skill than would be apparent to an uninitiated onlooker. If it did not, we may believe that it was a temporary or transition operation of a partially developed process. One of the continuous wonders of modern machinery is the application of the automatic principle, whereby all simple and monotonous operations are successively taken away from human hands.

More than a generation ago we were familiar with the factories where cut nails were made. In those factories the machines were fed by boys. Lines of machines would be ranged in a long room, with a boy at each machine, a hundred or more in a single room. The operation of feeding consisted in slipping the end of a strip of iron into the nail machine, allowing it to bite off a nail, then drawing back the strip, turning it over, slipping it in again for another bite, and so on indefinitely. If Bishop Potter could have seen those boys he might well have pitied them and have thought their outlook a hopeless one. The boys were banished by the automatic feeding devices later employed. The same process is continually going on with all machinery. It is always possible to find a poor fellow whom we can well pity as the slave of some steady and constantly operating piece of mechanism, but the proportional number of such fellows to the whole community is a constantly decreasing one. It is a simple and easily demonstrated fact, which we have heretofore called attention to in these columns, that the proportion of skilled to unskilled labor constantly increases.

Bishop Potter will be able to find a lesson on the mission of machinery in the means employed for the erection of the cathedral of St. John the Divine. The derricks that stand in the midst of that noble work represent the emancipation of man by machinery from the most unwelcome phases of his toil. When the vast pile shall have been completed, it will, as a whole, be the work of a higher average class of men and a better paid class of men than have ever built a cathedral before. It will show more work per man employed than ever before. We do not believe that Bishop Potter could or would pull down the derricks. He might regard with pity the engineers of those derricks as in process of transformation into simple idiots—if we may be pardoned for the application—but what of the thousands of sweating, tugging, shouting men that would otherwise be required?

It is, of course, true that the attendance of automatic machinery often involves monotonous labor, but this proves nothing. The real question is, Which method involves the least amount of toil—that in which the forces of Nature supply the power and the hand merely directs, or that in which the power must be supplied by human muscle? If brain work is given more play and muscle work less, where is the drive toward idiocy? To this there can be but one answer.

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"A Lazy Kind of a Job."

The other morning, coming down on the elevated railroad train, we happened to get a seat at the front end of the front car, looking out over the engine. The train filled up, as usual at that time of day, until there was standing room only, and not much of that. Two gentlemen stood by us in the aisle, apparently business men, or they might have been lawyers, talking of various matters in a way to show that they were in no way deficient in intelligence or general information. As the conversation flagged a little, one of the gentlemen looking out in front remarked casually as a most natural and proper thing to say: "The engineer has an easy time of it; it's a lazy kind of a job," and the other gentleman accepted the remark.

Surely the seeds of ignorance lodge and

spring up and flourish in the most unexpected places. These men probably did not know that the wages of the engineers on the elevated trains are about double that of the conductors of those trains. They probably did know that the company is not in the habit of paying much for nothing. Now, we happen to be rather familiar with the trains of the New York elevated railroad. Our regular trip is about nine miles, and we get off at the twenty-first station from where we get on, the running time being forty minutes, or an average of two minutes between stations, including for each the starting from the station, the run between the stations, the stopping and the time actually stopped at the station, which often is not more than ten seconds. Some of the downtown stations are not more than a minute apart. When the end of the line is reached the engine skips one train and takes the next, thus getting perhaps four or five minutes to refill the tank with water, and then off again, and this kind of thing is kept up all the day.

When business is going regularly, the trains upon the elevated roads are run as closely to schedule as upon any road in the country. Although New York is usually thought of as a level city, there are grades on the elevated, and several of them, steeper than occur on any of the big railroads; there are several right-angled turns to be made, with block signals at each. After starting from the station, you will always see the engineer "hook her up," and the valve travel will be seen to be reduced about one-half until nearing the next station. If you get a front seat on an uptown train you will be able to watch the steam gage, and you will see the pressure vary twenty pounds or so during the stop at a station, and yet you will never see it get down very low or do much blowing off, however the grades may change. The stops at the stations must usually be made within a foot from the post, so that the gates will come right. Sometimes, when there is a slight sprinkle of rain, the rails will be slippery, and then the engineer will have to handle the throttle very anxiously. Although the stops are so short, the engineer on the one side, or the fireman on the other, often jumps down with an oil-can and gives a squirt on crank pin or slides. If there is an accidental delay of only a minute or two at any point, then the passengers begin to accumulate at the stations, the train becomes overcrowded, the stops at the stations inevitably become longer to allow the passengers to wrestle off and others to struggle on, and general demoralization ensues, and the engineer, of course, is blamed, if not discharged.

It would really seem that the "lazy kind of a job" is that of making such silly remarks. It would be well, perhaps, all around if we each knew a little more what the other has to do and how he does it.

Technical Books.

A TREATISE ON INTERMITTENT GEARS. Including a Bevel Gear Chart and Suggestions on Bevel Gears with Milled and with Planed Teeth; Special Forms of Gears; Also Tables of Pitches, Diagrams, etc. First Edition. Boston Gear Works, Boston, Mass. Price 50 cents.

This little book by Frank Burgess, while it has some of the features of the trade catalog, contains quite a collection of interesting and, to most readers, novel matter. Quite a variety of intermittent gear movements are shown by neat cuts and briefly described. If these were more generally known, and known also to be easily procurable, they would, perhaps, be more frequently employed. Other gears of various types are also treated of, internal gears, elliptical gears eccentrically mounted, also in pairs with the hole in the center, or singly and driven by an eccentric pinion, triangular gears also driven by pinion, mitre and other bevel gears, spiral gears, etc. Some tables of service in gearing computations and diagrams showing sizes of standard teeth are added.

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Personal.

Mr. A. Brotherhood, mechanical engineer, of Manning, Maxwell & Moore, sailed for Europe by the Cunarder "Lucania" May 8th.

Mr. Frederick B. Miles, of Bement, Miles & Co., sailed for Europe by the Red Star steamer "Southwark" May 5th.

Prof. and Mrs. John E. Sweet sailed for Europe by the "Lucania" May 8th. The professor has promised to write us of some of the interesting things which he sees in his travels, which are likely to be very extensive. His health is somewhat impaired, and the best wishes of all for its complete restoration will follow him.

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Hartford Meeting of the American Society of Mechanical Engineers.

The programme of the spring meeting, from May 25th to 28th, has been issued. The following is the list of papers:

"Diagrams for Relative Strength of Gear Teeth." Forrest R. Jones.

"Experiments in Boiler Bracing." F. J. Cole.

"Adiabatics." De Volson Wood.

"New Form of Transmission Dynamometer." Fred'k A. Bedell.

"Fuel Gas Analysis in Boiler Tests." R. S. Hale.

"Hygrometric Properties of Coals." R. C. Carpenter.

"Electricity versus Shafting in the Machine Shop." Chas. H. Benjamin.

"Electrical Power Equipment for General Factory Purposes." D. C. Jackson.

"Volumnar Contraction of Cast-Iron." Francis Schumann.

"On Rating Electrical Power Plants upon the Heat-Unit Standard." W. S. Aldrich.

"The Laws of Cylinder Condensation." A. L. Rice.

"Tests of Sulzer Engines." H. A. Hill.

"Method of Accounting to Determine Shop Cost and Selling Price." H. M. Lane.

"History and Development of the Bicycle." Leonard Waldo.

"Tests of Centrifugal Pumping Engines, at Sewerage Station at Chicago, and Calibration of Large Weir." R. C. Carpenter.

"Current Practice in Engine Proportions." John H. Barr.

"A Continuous Steam Engine Indicator." Thos. Gray.

"The Best Load for Compound Steam Engine." A. K. Mansfield.

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Convention of the American Foundrymen's Association.

The convention of this association is being held this week at Detroit, Mich. The following is the list of papers to be read:

"Cupola Practice, Melting and Controlling Mixtures of Iron." James A. Beckett, superintendent, Walter A. Wood Company, Hoosic Falls, N. Y.

"The Value of Chemistry in the Foundry." S. S. Knight, chemist of the Addyston Pipe & Steel Company, Cincinnati, O.

"Description of a Swiss Iron Foundry." Henry Gretener. (This paper will describe a large modern European iron foundry, and will be illustrated with over twenty stereopticon views. It has been prepared with the greatest care, and will be very interesting to American foundrymen as showing how things are done across the water.)

"Crucible Making, and How They Should Be Cared For." John A. Walker, vice-president and treasurer of the Joseph Dixon Crucible Company, Jersey City, N. J.

"Notes on Pipe Founding." S. Groves, of the Taylor, Wilson & Co., Pittsburg, Pa.

"The Value and Use of the Different Alloys in Brass Founding." F. J. Davis, of the Cowles Electric Smelting & Aluminum Company, of Lockport, N. Y.

"Compressed Air." J. F. Lewis, of the Rand Drill Company, New York and Chicago.

"Elevators and Yard Cranes." G. A. True, of the Whiting Foundry Equipment Company, Chicago, Ill.

"Chilled Castings." E. H. Putnam, the Chattanooga Plow Company, Chattanooga, Tenn.

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We note with much pleasure that Mr. T. R. Almond has been awarded the John Scott Legacy Medal and Premium by the Franklin Institute for his flexible metallic tube.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(63) G. T. C., St. Louis, Mo., asks: How can I fix lead-pencil marks or sketches so that they cannot be easily erased? A.—Sponge them with milk carefully skimmed, then lay blotting paper over and iron with a hot flat iron.

(64) G. G. C., Pittsburg, Pa., asks: What advantages would a rotary engine have over a common reciprocating engine? A.—The presumed advantages of an imaginary rotary engine, or, as some would say, the ideal rotary engine, are reduced weight and space occupied and higher speed of rotation. The disadvantages of the actual rotary engine would fill a big book.

(65) H. G., of Zurich, Switzerland, asks for information about the method followed by the De La Vergne Refrigerating Machine Company in the fitting up of their crank shafts, and whether the same are made from the solid or built up. A.—We believe the De La Vergne Company do not make their own crank shafts. They are, however, from the solid, which is the practice here of most makers of crank shafts of this character—the tendency being to substitute the one-piece shaft for the built-up construction.

(66) W. F. P., Navy Yard, Washington, D. C., asks: Is it practical to cut a left-hand worm wheel with a right-hand hob cutter, provided you throw the hob as many degrees to the left as will give the tooth of the wheel, when cut, the same angle it would have if cut with a left-hand hob set correctly at right angles to the axis of the worm wheel? A.—A right-hand hob cannot be made to cut a left-hand worm wheel correctly. The hob might, as suggested, be so set as to give the tooth the correct angle at the center, but the curve of the tooth each way from the center would not be correct. If anyone will make a letter S and then make the letter reversed, as some amateur sign-painters sometimes do, there will be no difficulty in catching on to the idea. The central portion of the S suggests the curvature of tooth face for one worm, while the reversed S will suggest that of the other.

(67) C. V. F., Stanton, Ia., writes: In casting journal brasses in the drag, the brasses don't come sound. It does not show until I bore them, and I find that there are small holes, so I have been making them in the cope; is there any way to overcome this? A.—Mr. L. C. Jewett, to whom the above was referred, answers as follows: "The trouble he experiences is due to wet sand or very close sand. Sand for brass work cannot be used as damp as for iron, for when the brass or composition touches the sand, a thicker film, or skin, as the foundryman calls it, is formed, and if bubbles of steam occur they are imprisoned under this skin. Sand should be used as dry as possible, and be thoroughly or evenly tempered or moistened. It should be rammed firmly, swabbed as lightly as possible, metal poured at low heat for journal boxes, and success should follow. To make assurance doubly sure, blow molasses water or sour beer on the mold, then skin dry."

(68) "Pressure," Cambden, N. Y., asks: 1. Would it be safe to carry 100 pounds air pressure in a 30-gallon galvanized house boiler tested to 150 pounds water pressure? A.—The risk would not be great, although the factor of safety would be small. We would certainly want to see the 150 pounds water pressure applied, or to have some better assurance of its actual application than the customary stenciled statement which those tanks carry. 2. If the boiler with the 100 pounds pressure of compressed air should explode in a frame building 18 x 24 feet, with 10-foot ceiling and one floor, would it knock the "daylights" out of the building and kill the engineer; that is, would the bursting be necessarily disastrous? A.—The force of the explosion would not be nearly as great as that of a steam boiler of the same capacity and pressure. It would not "wreck" the building, nor do very serious damage; still, when the explosion occurred, we would prefer to be somewhere else.

(69) H. P. K., Freeport, Ill., asks: Can you give me a formula for making a hektograph pad for duplicating mechanical drawings, a pad from which the impression can be easily washed or removed when a sufficient number of copies have been taken. A.—There are several recipes both for the pad and the ink, none of which we can guarantee as best. Soak an ounce of gelatine overnight in enough cold water to cover it well, taking care that all the gelatine is swelled. Dissolve two ounces of salt in a pint of water for a bath. Heat six or seven ounces of pure glycerine over the salt-water bath to a temperature of 200 degrees Fahr. Pour off from the gelatine all the water remaining unabsorbed, and add the gelatine to the hot glycerine. Continue the heating for an hour, carefully stirring the mixture occasionally, avoiding as much as possible the formation of bubbles or froth. Add twenty drops of oil of cloves to prevent decomposition. The composition is to be poured into a flat vessel of sufficient area and allowed to stand level until cool. To prepare the pad for copying, it is necessary to pass a wet sponge lightly over the face and allow it to nearly dry before taking the first copy. After taking the desired number of copies, or when the impression is exhausted, the pad is to be washed lightly with a sponge wet in cold water and allowed to dry before using again. For ink, use a strong aqueous solution of aniline black, in the proportion of about 1 of the coloring material to 5 or 7 of water. It should be a saturated solution and rather thick.

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American Cars for London—English Builders Too Busy.

In the British House of Commons, April 30th, the President of the Board of Trade said that the Government was not prepared to compel companies applying for new railway charters to buy their equipment in the United Kingdom. In the case of the Waterloo City Railway, he added, twenty-two cars had been ordered in America, because out of the seven English firms bidding for the work not one of them was able to deliver the stock in the time required by the company.

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A. G. Kaufman, of Stanford University, has a little kink for mentally determining the cube root of all *perfect* cubes up to 1,000,000. The only thing necessary to remember is a list of the cubes of the first nine numbers, which it is handy to know on general principles:

$1^3 = 1$	$4^3 = 64$	$7^3 = 343$
$2^3 = 8$	$5^3 = 125$	$8^3 = 512$
$3^3 = 27$	$6^3 = 216$	$9^3 = 729$

The cube of any number above 10 must consist of at least four figures. Point off the three at the right and note the highest cube in the figures at the left of the point. This will be the first figure of the required root. By noticing the last or right-hand figure in the above list it will be seen what the second figure of the root must be. What is the cube root of 658,503? The highest cube in 658 is 512, whose root is 8, and as the last figure at the right of the complete cube is 3, the only figure in the root which could produce it is 7, so the cube root must be 87.

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Commercial Review.

NEW YORK, SATURDAY EVENING, MAY 8.

THE MACHINE TOOL MARKET OF 1897.

It is universally acknowledged that last year was a star year for exports, especially for those of machine tools. Whether the present one will surpass the high standard set by its predecessor, or will even maintain it, is an important question, but it has not yet been answered, nor, we believe, thoroughly considered. In order to find a solution of this problem and take the bearings of the market, we have requested letters from a number of machinery concerns, and have received in reply the letters printed below, of which our readers may judge for themselves, but which seem to us, in regard to both foreign and domestic trade, of a favorable nature.

One other point must be called attention to, and that is the remarkably heavy total made by general machinery exports for March, as will be found under a special heading below.

From Bement, Miles & Co., Philadelphia, Pa.: "Our domestic trade during the first four months of this year has been somewhat in excess of last year's business for the same period, although at lower prices. There seems to be an increased demand, and the prospects for better business than we have had for some time past are encouraging. Our export business is very much better than it was last year, and as we are giving more attention to this branch than formerly, we have every reason to believe that our efforts will result in a very satisfactory trade abroad."

From the Brown & Sharpe Manufacturing Company, Providence, R. I.: "We think there are some favorable tendencies for domestic trade, although at present it is, as we all, unfortunately, know, very much more quiet that ordinarily. Our own export business for 1897 compares favorably with that for 1896, but some of our friends tell us that there are indica-

tions of a falling off in orders from abroad, and we are of the opinion that very much reliance cannot be placed upon a continuance of such orders. Business has been remarkably active abroad for a year or so, and under ordinary conditions very many less orders will be placed here. It also must be considered that a number of foreign manufacturers are preparing to copy American tools, and will in the future supply a portion of the demand for tools that have been purchased here."

From the Cincinnati Milling Machine Company, Cincinnati, O.: "We are able to report an increase in our foreign trade for the first four months of this year, as compared both with the first and last four months of 1896, and from all indications 1897 with us will equal or exceed 1896 in the amount of export business. Our domestic business for the first quarter of this year shows a substantial increase over the last quarter of last year."

From the Pratt & Whitney Company, Hartford, Conn.: "Business in the lines of this company is dull throughout the United States, and but little improvement is looked for before fall. The whole volume of trade differs but little from that of a year ago, the present lack of home orders being made good by an influx of orders from abroad."

We recently learned from the Mossberg & Granville Manufacturing Co., Providence, R. I., makers of power presses, small rolling mills, etc., that they were working night and day, principally on foreign orders. Home trade in the East showed some improvement, but in the West was very flat. Their competitors did not all appear to be busy.

From the Springfield Machine Tool Company, Springfield, O.: "The business situation with us may be briefly stated as follows: Our orders from domestic sources have improved to an appreciable extent, and as the volume of our foreign business is somewhat larger than during the last six months of 1896, we are busier than during any period in our history."

From Warner & Swasey, Cleveland, O.: "Our home trade seems to be increasing steadily, and present prospects seem to indicate that foreign trade will be nearly as large as last year. It is evident that foreign manufacturers are looking upon American tools with increasing favor, and we expect there will be a continued demand for them."

MACHINERY EXPORTS FOR MARCH.

The Monthly Summary of Finance and Commerce, prepared by the United States Treasury Department, shows that dutiable exports of machinery, including engines, boilers, printing presses, typewriters, sewing machines, etc., amounted, for March, 1897, to $2,936,157, as compared with $1,879,642 for March, 1896. For February, 1897, the figures were $2,211,562. The nine months ending with March, 1897, reached a total of $21,684,518, against $15,460,273 for the corresponding period a year previous.

The figures for February, 1897, were less than for the month preceding, and they showed an increase of only $311,659 over February, 1896, while those for March, 1897, are $1,056,515 in excess of March, 1896.

MISCELLANEOUS.

The Geometric Drill Company, New Haven, Conn., write us that the growth of their business during the past year has obliged them to seek more roomy quarters, which will be in Westville, Conn. From May, 1896, to May, 1897, they have doubled their capacity four times.

The Davis & Egan Machine Tool Company, Cincinnati, O., have declared a 3 per cent. dividend for the past three months.

The Campbell & Zell Company, Baltimore, Md., among recent orders, have received a contract from the Metropolitan Railroad Company, Washington, D. C., for 1,204 horse-power Zell improved water tube safety boilers, making a fifth order from said road, and aggregating nearly 3,000 horse-power of Zell boilers now in use in their several power-houses in Washington.

PITTSBURG REPORT FOR APRIL.

One of the chief characteristics of trade in the Pittsburg territory is the large amount of new work to be done, but which is exceedingly hard to close up, even a small portion of it. Those desiring machinery of any description do not seem anxious to make their purchases on the spur of the moment, but pursue a waiting policy. They do not think that they will secure lower figures, for prices could scarcely be lower than they are already, but they seem dubious as to the future. The so-called "improved business" has not struck them as hard as they thought it would; hence they do not care to make any great outlay upon their plants until the sky of trade is unmistakably clear.

The iron mills are probably the busiest of all the manufactories in this locality. Where men were formerly employed half-time, full time is now being made. The only bad feature of the iron industry is the continual "readjustment of wages," undertaken by many of the manufacturers.

Boiler people are continually on the hunt for new work. Several large contracts are expected shortly to be closed for boilers, aggregating many horse-power. The National Tin Plate Company, of Anderson, Ind., has just selected

(Continued on page 36.)

Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Ct.

Engine Castings ¼ to 2 H. P. Finished boilers and engines. Grant Sipp, Paterson, N. J.

Send $1 to the Tabor Mfg. Co., Elizabeth, N. J., for improved stop-motion revolution counter.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday Morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

Thor. machinist, wants posi. Box 209, AM. MACH.

General machinist, tool maker, vise or machine hand, wants position. Box 215, AMER. MACHINIST.

All-round tl. & die mk'r, always wkd. in N. E. States, would like to go to Wstn. city. Box 207, AM. MACH.

Mech. draftsman and designer, tech grad., exper. machinist, wants pos. Box 201, AMER. MACHINIST.

Mech. eng. wants pos. June 1; exp. in electricity, also in design of automatic and general machinery. Box 217, AMERICAN MACHINIST.

Foreman pattern maker, with an extensive practical exp., wishes a position. First-class ref.; salary moderate. Address Box 218, AMER. MACHINIST.

Foreman patternmaker, wants posi.; good and fast work guaranteed on large or small patterns; references. Address Box 210, AMER. MACHINIST.

Tech. grad. of mech. eng., with shop experience, competent draftsman, wants to be assistant to a superintendent or mechanical engineer. Will draft temp. if desired. Box 212, AMERICAN MACHINIST.

Wanted—Sit. in or near Chicago on machinery requiring exp., industry and ability. Can take charge of shop. Address Box 213, care AMER. MACHINIST.

First class draftsman and pattern maker wants position where good practical knowledge of both trades would be appreciated. Box 203, AM. MACH.

Exp. machinist and draftsman, who has served as general foreman in different shops throughout the country, desires position as foreman or supt. Best of references. Box 216, AMERICAN MACHINIST.

Situation wanted by a first-class toolmaker, experienced on jigs, cutters, dies, fixtures and fine special machinery; fair draftsman; have had charge of work. Box 214, AMERICAN MACHINIST.

Mech. eng., 30, wide experience and education, mem. A. S. M. E., owns valuable pats. on gas engs. for direct cp'd. elec. serv., desires con. with subtl. concern needing eng. or supt. Box 198, AM. MACH.

A party with a number of years' exp. in mfg. companies desires a situation as assistant to some mfg. co. Details and management of help pref. Ref. furn. Ad. M. W. C., P. O. Box 1829, Boston, Mass.

Situation Wanted—By all-round machinist of 25 years' experience; 15 years constructing and erecting ice refrigerating plants; position in shop or as outside man; best of references given as to ability and character. Box 208, AMERICAN MACHINIST.

Help Wanted.

Reliable mechanics to sell my calipers, etc.; good pay. Address E. G. Smith, Columbia, Pa.

Wanted—A draftsman on general work. Write giving experience and wages expected. Address Box 202, AMERICAN MACHINIST.

Wanted—An exp. mech. draftsman, who can give good ref. as to character and ability. Position permanent to one who can fill the position satisfactorily. Address Box 211, AMERICAN MACHINIST.

Wanted—Machine shop foreman in job shop to handle night gang of about 25 men; must be experienced. State wages wanted and send copies of references. Address by letter only, N. J. & P. C. Works, Edison, N. J.

Wanted—Machine tool contractor; thoroughly practical and capable of handling 50 men, to manufacture engine lathes, and with enough money to buy a one half interest; business well established. Address Box 204, AMERICAN MACHINIST.

Wanted—For small mach. shop emp. about 30 men. Only those well up on high speed engine work and familiar with mod. meth. of getting out work at lowest cost need apply. State exp. in detail and wages exp. "Western New York," care AM. MACH.

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Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d h'd lathes & planers. S. M. York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

The Dutton Wet Twist Drill Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

(Continued on page 36.)

(Continued from page 35.)

a site on the Monongahela River, at Fordham, near Charleroi, Pa., on which to erect a nine-mill tin plate plant. It is understood that the engines for this plant will be made by the E. P. Allis Company, of Milwaukee, Wis.; but nothing yet has been done concerning the boilers, etc. The Washington Sheet & Tin Plate Mills, at Washington, Pa., have let contracts for doubling the capacity of the works. It is likely that the same make of engines (Philadelphia Corliss) already in use and Brownell boilers will be installed. Another new plant talked of is to be erected at Corry, Pa., on the Allegheny Valley Railroad, by Benj. Lauth, the well-known furnace builder, and other capitalists of Pittsburg. A large amount of machinery will be wanted here.

Builders of electric-light plants are working to install an electric-lighting system, modern in every way, in the large plant of Jones & Laughlin. In many other places improvements are talked about, but they do not come to a head very fast. Figures are gotten on the construction, etc., and then filed away for some future time, when the outlook appears to be somewhat better.

Quotations.

NEW YORK, Monday, May 10.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$12 00 @ 12 50
No. 2 foundry, Northern	11 00 @ 11 25
No. 2 plain, Northern	10 50 @ 11 00
Gray forge, Northern	9 75 @ 10 25
No. 1 foundry, Southern	10 25 @ 10 75
No. 2 foundry, Southern	9 75 @ 10 00
No. 3 foundry, Southern	9 50 @ 10 00
No. 1 soft, Southern	10 00 @ 10 25
No. 2 soft, Southern	9 75 @ 10 00
Foundry forge, or No. 4, Southern	9 25 @ 9 50

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.00 @ 1.05c.; refined, 1.10 @ 1.25c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.35 @ 1.45c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some brands perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.50 @ 1.55c.

Cold Rolled Steel Shafting—Base size, 2.50 in small lots, from store.

Copper—Carload lots, Lake Superior ingot, 10¾ @ 11c.; electrolytic, 10½ @ 10¾c.; casting copper, 10¼ @ 10½c.

Pig Lead—In carload lots, 3.30 @ 3.35c., f. o. b., New York.

Pig Tin—For 5 and 10-ton lots, 13.30 @ 13.40c., f. o. b.

Spelter—In carload lots, New York delivery, 4.10 @ 4.20c., f.o. b.

Antimony—Cookson's, 7¼ @ 7½c.; Hallett's, 7 @ 7¼c.

Lard Oil—Prime city, present make, commercial quality, in wholesale lots, 38 @ 40c.

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New Catalogs.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

We have received from the Rand Drill Company, of New York, N. Y., a catalog of rock drilling and air compressing machinery. Various styles of rock drills are shown. The catalog is 6¾ x 10 inches.

The Crown Cork & Seal Company, of Baltimore, Md., have sent us a nicely gotten up catalog descriptive of machinery used for stopping bottles. Full details regarding parts

(Continued on page 37.)

(Continued from page 35.)

Models, experimental and small special machy. built. Write to Crocker & Lawson, Binghamton, N.Y.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O

For Sale—Telescope 3½ ins. aperture; alt-az. mounting; powers 50 to 200 dia. Address O. L. Petitdidier, Mount Carmel, Ill.

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co., Middletown, Ohio.

Wanted—Every reader of this paper to send 35 cents for The Tool Catalogue. See Montgomery's advertisement on page 40 of this edition.

Model Locomotives—Complete castings, latest N. Y. Cen. standard, up to date; 4c. in stamps for catalog. G. H. Olney, 163 Herkimer St., Brooklyn, N.Y.

Wanted—Inventors before applying for a patent get "How to Apply for a Patent," $1. Sample pages free. Henry F. Noyes, 56 Liberty Street, N. Y.

Wanted—An Idea. Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write John Wedderburn & Co., Patent Attorneys, Washington, D. C., for their $1,800 prize offered to inventors.

English agency wanted by a consulting engineer, with good connection among buyers of pumping, brewers' and general machinery; central offices and show room; references given. Bernard H. Springett, 31 Mansion House Chambers, London, E. C.

A machine shop, with modern equipment, heavy and light machinery, cranes of 20 tons capacity and 10,000 square feet of unoccupied floor space, would contract to manufacture any kind of machinery. Parties already having machinery built under contract might do well to write us for estimates. Box 62, AMERICAN MACHINIST.

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TAPPING MACHINE
25,000 holes tapped per day.
Description mailed.
Machinery and Tools.
Brass Machine Screws.
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Bridgeport, Conn.

Hand-Power Steel Cutting-Off Machine,
Rotary Motion, Automatic Feed, Self-Oiling.

Cuts off solid stock, round, square, oblong, etc.
Send for circular.
George W. Haskell, 4 So. Canal St., Chicago, Ill.

CINCINNATI, O.
R. K. LeBLOND,
Manufacturer of
Machine Tools,
Pearl & Plum Sts.
CINCINNATI, O.

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Implements are adjusted at a temperature of 75°.
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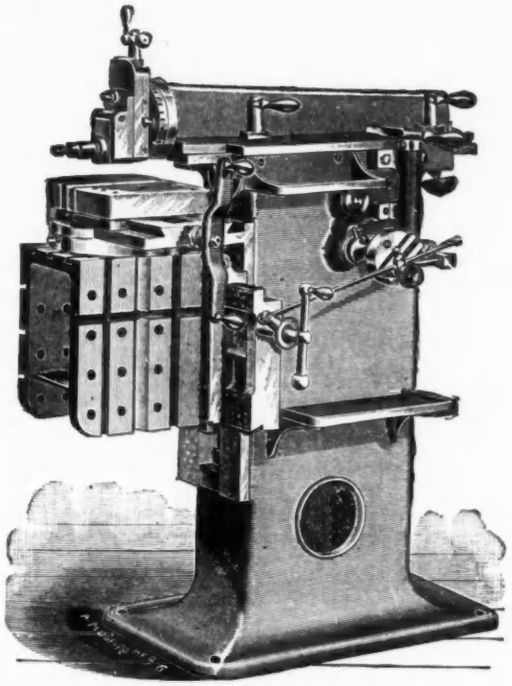

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Strong and Powerful.

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Die Work, Tool Room or General Shop Work.

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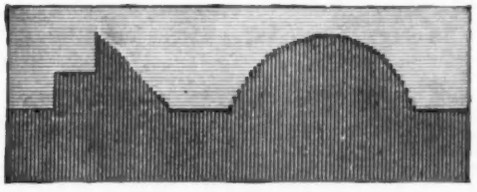
The stroke can be adjusted for curves with machine in motion. The stroke can be adjusted for angles with machine in motion. The stroke can be adjusted for irregular work with machine in motion. It has adjustable table for planing taper work; table can be removed for fastening work to apron. Has a strong graduated swivel vise. Quick work, rapid changes, modern ideas.



This cut shows how stroke can be adjusted with machine in motion by micrometer; adjustment fine and delicate. SEND FOR CIRCULAR.

▲ ▲ ▲ ▲

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European Agents, { **CHAS. CHURCHILL & CO., London and Birmingham.**
SCHUCHARDT & SCHÜTTE, Berlin and Vienna.
EUGEN SOLLER, Basel, Switzerland.

(Continued from page 30.)

of the machine are given, and the catalog is 8 x 10 inches.

Charles H. Besly & Co., Chicago, Ill., have sent us their catalog D of machinists' tools and supplies. Along with each description, prices are given, and the catalog contains a good amount of useful information. It has 282 pages, and is 4½ x 8½ inches.

We are in receipt from the American Impulse Wheel Company, of New York, a catalog entitled "The Perfect American Hurdy," in which is described the Cazin power wheel. A table of pressure equivalents, horse power, etc., is given, and the catalog is 6¾ x 9½ inches.

▲ ▲ ▲

Manufactures.

At Burlington, Vt., Spear Bros. are fitting up new shops.

At Binghamton, N. Y., Mr. George A. Kent will erect a new factory.

At Red Bank, N. J., the Jones Fertilizer Company will install machinery.

At Gorham, N. H., E. Libbey & Sons are erecting an addition to their plant.

At Mansfield, O., the Ohio Brick & Tile Works have been destroyed by fire.

The Jansen Iron Company, of Columbia, Pa., will erect additional furnaces.

The Automatic Can Machinery Company, of Westfield, N. J., has been organized.

Dubois Iron Works, of Dubois, Pa., contemplates the addition of new machinery.

The factory of Burnham & Morrill, at Auburn, Me., has been destroyed by fire.

Conroy, Prugh & Co., of Allegheny, Pa., will soon erect a boiler and engine house.

Messrs. Young & Thomas, Watertown, Tenn., intend to install new machinery.

The Brightman Manufacturing Company, of Millersburg, O., will enlarge their plant.

The pipe foundry of J. C. Hodgson, at St. Henri, Que., Canada, will reopen shortly.

At Norwalk, O., the Van Nette Pump Purifier Company, of Tiffin, will erect a plant.

The Rome (Ga.) Rolling Mills will be converted into a car-wheel and steel-rail works.

Messrs. R. & H. Simon, of Easton, Pa., contemplate the erection of a new weaving mill.

The Bevin Bros. Company, of East Hampton, Conn., is erecting an addition to its plant.

Leechburg Machine Company, of Leechburg, Pa., is having an addition erected to their plant.

At Savannah, Ga., Mr. W. T. Swain and others will erect a foundry and machine works.

The Millview Gold Mining Company, of Fredericksburg, Va., will install new machinery.

The Cox Computer Company has removed its office from 173 to 74 Greenwich street, this city.

At Myerstown, Pa., Mr. W. E. Edgett, of Smithbridge, Mass., will establish a machine-manufacturing plant.

At Elizabeth, N. J., the plant of the Brooklyn & New York Railroad Supply Company was recently destroyed.

The American Gas Furnace Company, of New York City, has removed from 80 Nassau street to 23 John street.

The foundry and machine shop of C. Norsworthy & Co., at St. Thomas, Ont., was recently destroyed by fire.

The Somerville iron foundry, Somerville, Mass., and owned by Mildram & Reed, was recently destroyed by fire.

At Chicago, Ill., Messrs. Greenlee will erect

a foundry on Halsted street. It will be four stories high and 100 x 175 feet.

Mr. George S. Comstock, of Mechanicsburg, will erect an addition to his foundry and machine shop at some future time.

At Chicago, Ill., the Advance Packing & Supply Company has been formed. Incorporators: Ed. Wertheim and F. A. Adkins.

Messrs. R. Hoffeld & Co., of Buffalo, N. Y., have taken up the agency of the Groton & Knight Manufacturing Company, of Worcester, Mass.

At Chicago, Ill., the Davis & Ludwig Foundry Co. has been incorporated. Frank B. Davis and Oscar Ludwig are the incorporators.

Jones & Laughlin, Pittsburg, Pa., are making additions in their plant, among which is an extension for the manufacture of structural iron.

At Chicago, Ill., the Chicago Mining Machine Company has been incorporated; capital, $30,000. Incorporators: J. B. Paine, S. W. Bender.

At Chicago, Ill., the Eastlake Manufacturing Company has been formed. Incorporators: Henry M. Seligman, I. S. Adler and I. S. Richter.

The Norton Nail Company, of Ashland, Ky., contemplate the erection of a rod mill at that place. Judge H. M. Houston is president of the company.

The plant of the Bridgeport Wood Finishing Company, at New Milford, Conn., has been visited by fire, and damaged to the extent of $20,000.

At Waynesboro, Pa., the plant of Landis Bros. will be rebuilt, and a stock company will be formed. The company will be known as the Landis Tool Company.

At Baltimore, Md., the Keen & Hagerty Company has been formed by James R. Hagerty and Charles L. Wagandt and will engage in the manufacture of tinware.

At Madison, Wis., the Hart-Parr Company has been formed for the manufacture of engines. Messrs. Charles W. Hart, C. H. Parr and John H. Bowman were the incorporators.

A furniture company, known as the William P. B. Schmitt Furniture Company, has been incorporated at Baltimore, Md. Joseph H. Holtman, George J. Woelfel and John Beck are incorporators.

At Baltimore, Md., the Keen & Hagerty Company has been incorporated. James H. Hagerty, James R. Hagerty, etc., are interested. The company will engage in the manufacture of tinware.

The new firm of Garrels & Freeman, consulting engineers and contractors, has been formed at 105-107 North Sixth street, St. Louis, Mo. They desire manufacturers to send them catalogs.

The Geometric Drill Company, of New Haven, Conn., have moved from that place, and are now located in a new factory at Westville, Conn. It is the intention of the company to add new machinery.

At Jackson, Mich., the Geo. T. Smith Manufacturing Company has been organized to engage in the manufacture of flour mill machinery. Those interested are D. S. Smith, George T. Smith and H. H. Smith.

The National Tin Plate Company, composed of W. H. Donner, of Anderson, Ind.; D. P. Erwin, of Indianapolis, and J. I. Irwin, of Columbus, have purchased a tract of land, on which they will erect a new plant.

At Winchester, Ind., a tin-plate factory will be erected by the American Manufacturing Company. The manufacture of tinware will be engaged in. The capital stock of the company—of which the following gentlemen are incorporators: T. J. Boher, L. A. Wilson, of Washington; C. W. Moore, J. W. Thompson, B. F. Hill, of Winchester—is $125,000.

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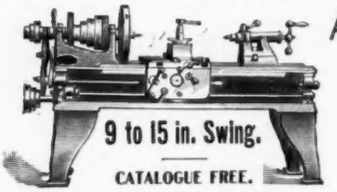
New York—123 Liberty Street.



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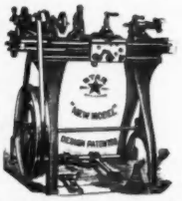

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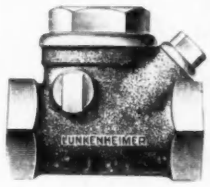

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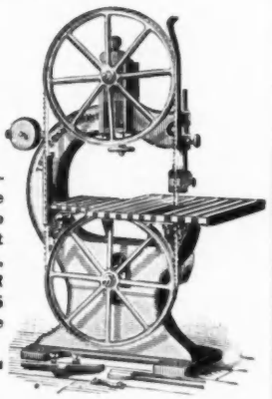

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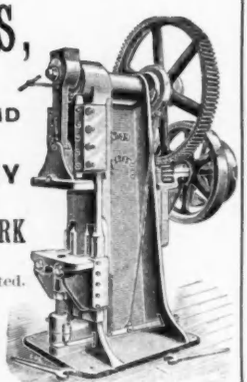

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Wells Bros. & Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

TOOL CATALOGUE.

Strelinger & Co., Chas. A., Detroit, Mich.

TOOL GRINDERS.

Gisholt Machine Co., Madison, Wis.

TOOL HOLDERS.

Armstrong Bros. Tool Co., Chicago, Ill.
Gould & Eberhardt, Newark, N. J.

TOOLS, MECHANICAL, FINE.

Brown & Sharpe Mfg. Co., Providence, R. I.
Standard Tool Co., Athol, Mass.
Sawyer Tool Co., Athol, Mass.
Starrett Co., L. S., Athol, Mass.

TURRET LATHES (Screw Machines).

Bardons & Oliver, Cleveland, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Machine Tool Co., Bridgeport, Conn.
Cleveland Machine Screw Co., Cleveland, O.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dreses, Mueller & Co., Cincinnati, O.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Machine Co., Springfield, Vt.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
Warner & Swasey, Cleveland, O

VALVES.

Consolidated Safety Valve Co, New York.
Jenkins Bros., New York.
Kelly & Jones Co., New York.

VARNISHING MACHINE.

Heim & Co., Friedr., Offenbach, Germany.

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VISES.

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McCabe, J. J., New York.
Niles Tool Works Co., New York.
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Backus Water Motor Co., Newark, N. J.

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Trenton Iron Co., Trenton, N. J.

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Bentel & Margedant Co., The, Hamilton, O.
J. A. Fay & Egan Co., Cincinnati, O.
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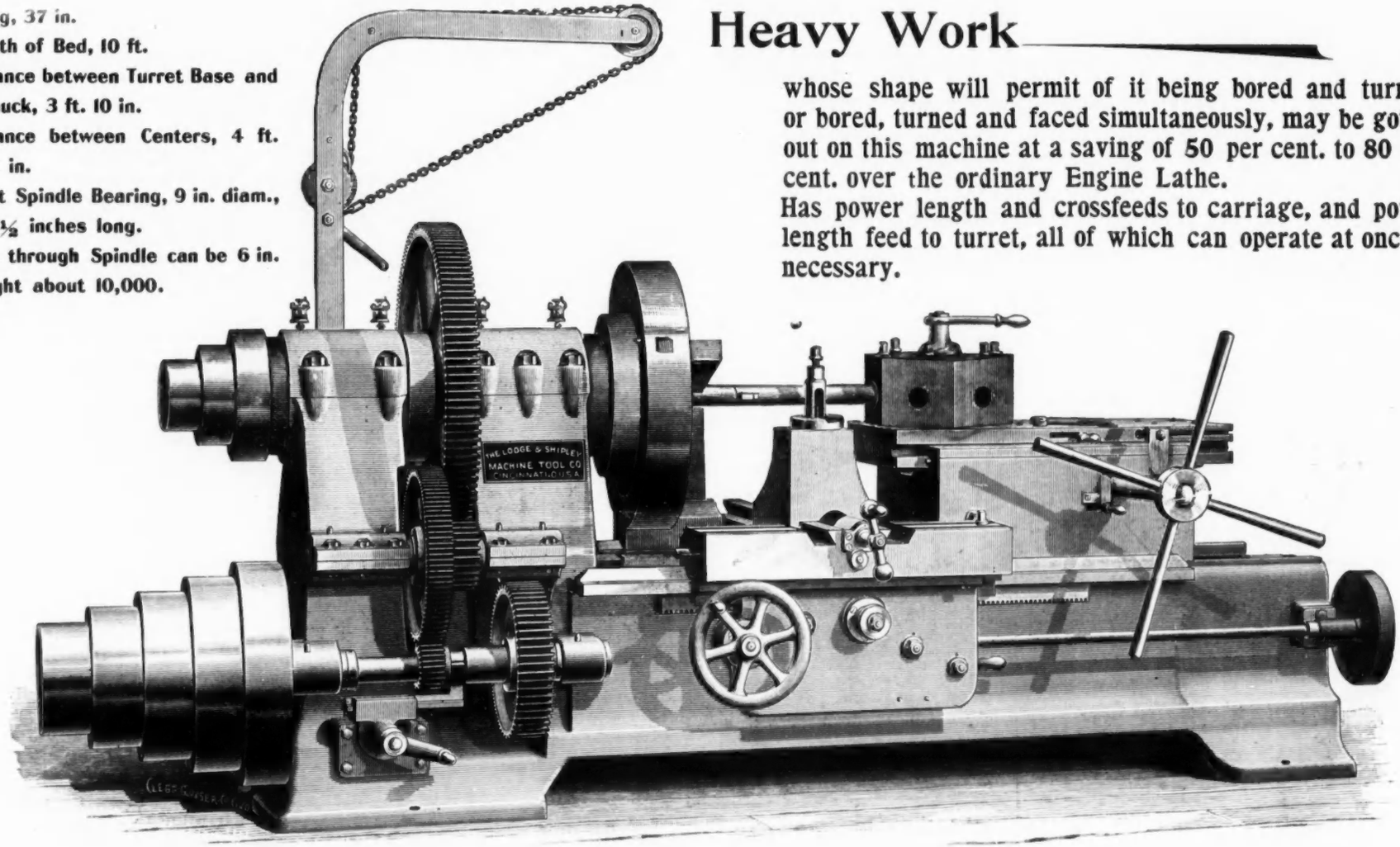

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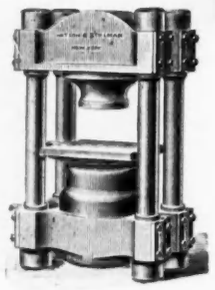

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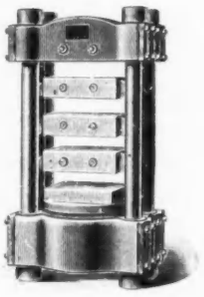

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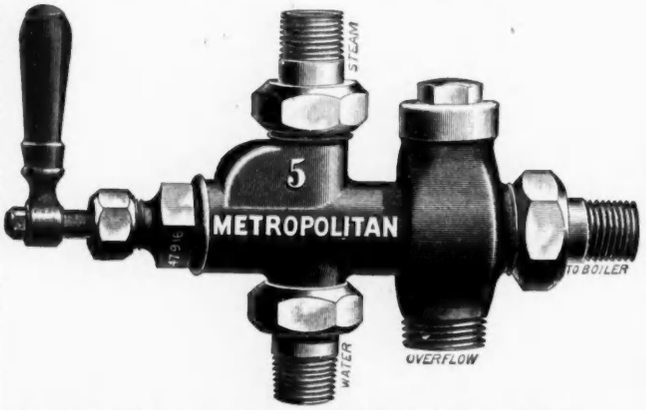

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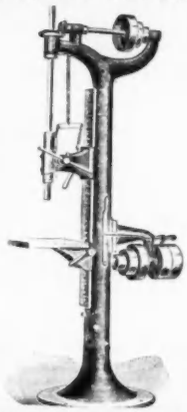

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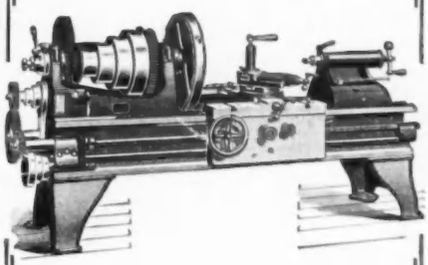

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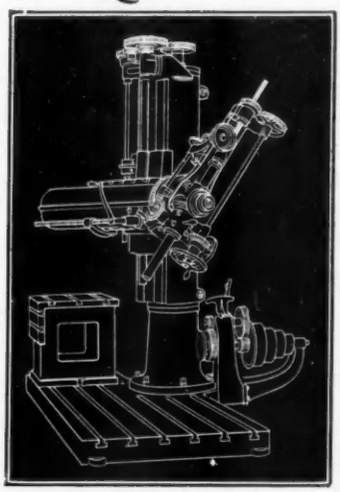

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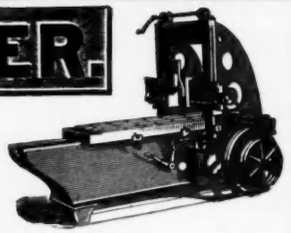

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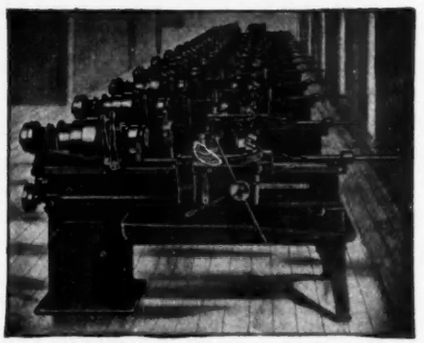

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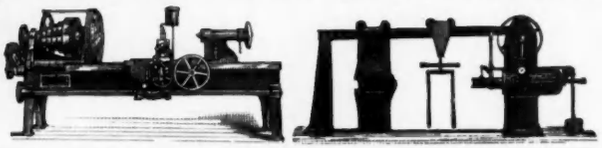

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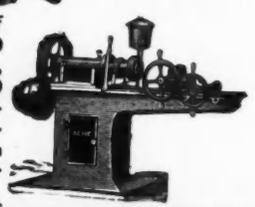

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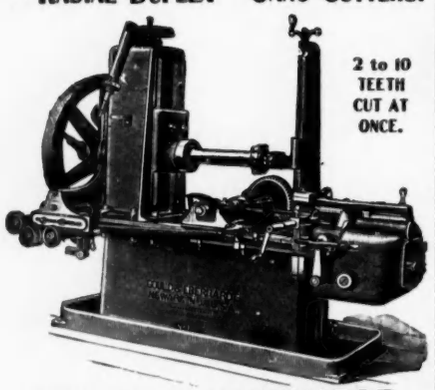

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